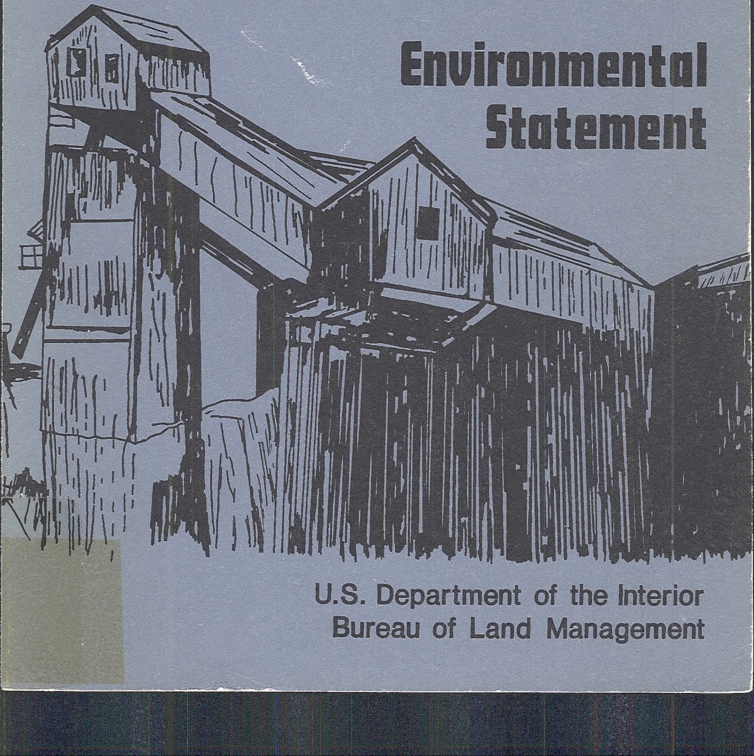
Volume 2

DRAFT
West-Central Colorado Coal



Environmental Statement

U.S. Department of the Interior
Bureau of Land Management

VOLUME 2

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NO. 1 AND NO. 3 MINES

CHAPTER 1

DESCRIPTION OF THE PROPOSAL

Proposal

The proposed federal action is the review and consideration for approval of a mining and reclamation plan submitted by Anschutz Coal Corporation to expand the Thompson Creek No. 1 and No. 3 underground mines. The plan was submitted in accordance with 30(CFR): 211 regulations to the Area Mining Supervisor, United States Geological Survey (USGS), Denver, Colorado, November 18, 1976, and modified April 17, 1978. It describes the Thompson Creek operation, whose facilities are located on private land approximately 12 miles southwest of Carbondale, Pitkin County, Colorado (see map 1 in appendix A, which shows the regional ES area).

This underground mining operation would produce approximately 1 million tons of coal per year from reopened mines, which were abandoned in 1966. The total mine area would involve approximately 4,000 acres. Production would be from (1) a 1,200-acre parcel of land whose surface is administered by the U.S. Forest Service (USFS) and which is a portion of two existing federal coal leases C-08172 and C-08173, totaling 4,935.20 acres, and (2) an adjacent 2,800 acres of contiguous private land (map A1-1 shows the leases). The operation would use advancing entries to establish longwall panels which would be extracted by retreating methods. The coal would be transported by rail to the west, where it would supply metallurigical markets. The life of the operation is estimated at 30 years. The Thompson Creek mining and reclamation plan and supporting data are on file at the office of the Area Mining Supervisor, USGS, Denver, Colorado, and are available for public review.

This mining and reclamation plan was submitted for review prior to promulgation of the initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) and has not been officially reviewed for compliance with that act. Therefore, the applicant's plans may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations. The mining and reclamation plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plans cannot be approved until they conform to all applicable federal requirements.

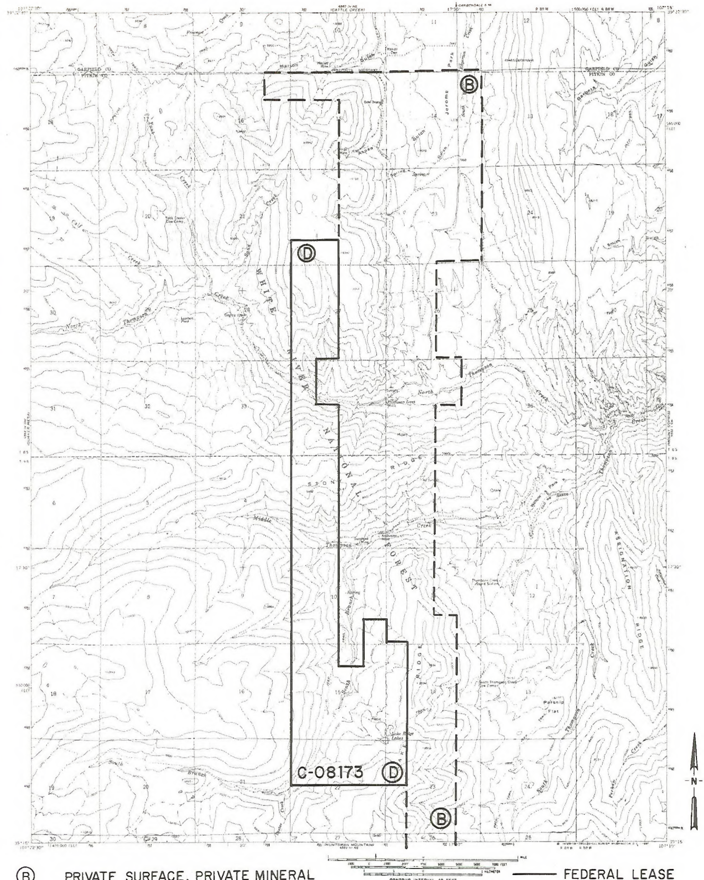
History and Background

The Colorado Fuel and Iron Corporation (CF&I) operated in the Thompson Creek area from 1898 through 1904, producing 745,000 tons from the Coal Basin Mines of Mid-Continent Coal and Coke Company. In addition CF&I produced 142,765 tons of coal from the Union Mine (1896 to 1902) and 3,371,943 tons from the Spring Mine (1887 to 1912). The Thompson Creek Coal and Coke Corporation produced coal from private land in the area from 1952 through 1966.

Coal prospecting permits for the area covered by the federal leases were issued to Larson Mining of Denver, Colorado, in June 1954; they were extended to June 1958. On March 19, 1958, Larson Mining transferred the permits to Chactaw Mining Company, Inc., of Fort Smith, Arkansas. Preference right coal leases were issued to Chactaw, June 1, 1958. On June 5, 1964, Chactaw merged with Garland Coal and Mining Company of Fort Smith, Arkansas. On November 1, 1977, the Bureau of Land Management (BLM) transferred the leases from Garland to Anschutz. The lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.

Predisturbance Inventories and Analyses

Specific inventories have been conducted or are pending under the direction or cooperation of the Anschutz Coal Corporation in consultation with the USFS concerning threatened or endangered plants, archeological sites, historical sites, and paleontological locations. A detailed literature search and herbarium survey indicated that none of the federally proposed endangered or threatened plants within the region is known to have occurred historically in the area of the Thompson Creek mine. No archeological inventory has been con-



(B) PRIVATE SURFACE, PRIVATE MINERAL
(C) PUBLIC LAND SURFACE, FEDERAL MINERAL

——— FEDERAL LEASE
- - - PRIVATE LEASE

Map A1-1. Anschutz Coal Corporation's lease area

ducted on the lease area because no additional surface disturbing activities will take place on this land. Historical research by Athearn (1977) revealed no historical sites on project area lands. A review of geologic and paleontological literature revealed that it would be extremely unlikely that fossil vertebrates would be disturbed by Thompson Creek mining.

Stages of Implementation

Anschutz began construction of mine facilities on its private lands in 1975, with the expectation of reaching full production by 1980. In 1977, the operation produced 20,000 tons of coal from the private lands, using 140 employees. The production schedule indicates the mines would reach full production of 1.0 million tons per year by 1980 with a full employment level of 320 people.

Anschutz proposes to mine the full height of the 7- to 10-foot-thick A seam of the Bowie member and the 8- to 10-foot-thick Anderson seam of the Paonia member. The Bowie is the lower member of the Cretaceous Mesaverde group, and the Paonia is the upper member. The seams are 800 feet apart vertically. The roof of the Anderson seam consists of shales and sandstones; the floor of the seam consists of shale underlain by sandstones. The coal parts freely from the roof and floor. Anschutz indicated that the coal is of metallurgical (bituminous) quality and is medium volatile.

The B seam of the Bowie member, which is 4.7 to 5.75 feet thick at the outcrop, overlies the A bed by 30 to 40 feet. The seam splits south of Thompson Creek and thins rapidly in the Thompson Creek No. 2 mine north of Thompson Creek, making the seam unmineable. The Sunshine seam of the Paonia member is located about 60 feet below the Anderson seam. It is 2 to 6 feet thick and is also currently considered unmineable due to the variations in thickness. (Figure A1-1 is an aerial photograph of the North Thompson Creek No. 1 and No. 3 mines.)

Mine Layout

Anschutz proposes to develop three main entries northwest from the Thompson Creek No. 3 portal in the Anderson seam and from the Thompson Creek No. 1 portal in the A seam; they would be extensions of old workings (map A1-2 shows the mine layout). The entries would be developed by Alpine continuous miners and would be 14 feet wide on 60- to 70-foot centers. The two existing main slope entries of the No. 1 Mine would be extended cross-dip toward the northwest to the planned first submain entries where a third main slope entry would be added. The slope entries would be 14 feet wide on 60- to70-foot-centers.

Crosscuts in the main entries would also be developed by continuous miners and would be 14 feet wide on 100-foot centers. Submain entries would be developed both north and south from the main entries, using a two-entry system on 60- to 70-foot centers. The submains would be developed off the main entries on 400-foot intervals. Pillar and crosscut layout of the submain entries would be the same as for the main entries. Crosscuts on the submain entries would be developed by drilling and blasting with permissible explosives. Roof control in entries and the crosscuts would be by roof bolts and wooden mine props. The roof control system would be approved by the Mining Safety Health Administration.

The submain entries would be developed along the strike of the coal seam. In the Thompson Creek area, the general trend of the seam is north 13 degrees east, with a dip of 30 degrees northwest. On the two-entry system, this would put one entry approximately 20 feet higher than the other. The upper entry would be a track and return air entry; coal would be removed through the lower entry, which would also be the intake air entry. The 400-foot intervals of the submain entries would set longwall panels, which would be 400 feet wide and up to an optimum length of 8,000 feet. Longwall mining would be by retreat method using self-advancing hydraulic shields for roof support. (Other equipment is listed in table A1-1.)

Coal dust underground would be controlled by spraying the face with water from spray nozzles mounted on the Alpine miner and on the longwall shearing drum. All transfer points within the mine also would be sprayed with water. Coal from the mines would contain an estimated 5 percent moisture.

VENTILATION

The Thompson Creek mines would be ventilated by 150,000-cubic-feet-per-minute fans installed at the portal of one of the main entries of each mine. The fans would operate on a pull-type exhaust system. The ventilation plan would be required to meet all Mining Safety Health Administration standards.

MINE HAULAGE SYSTEM

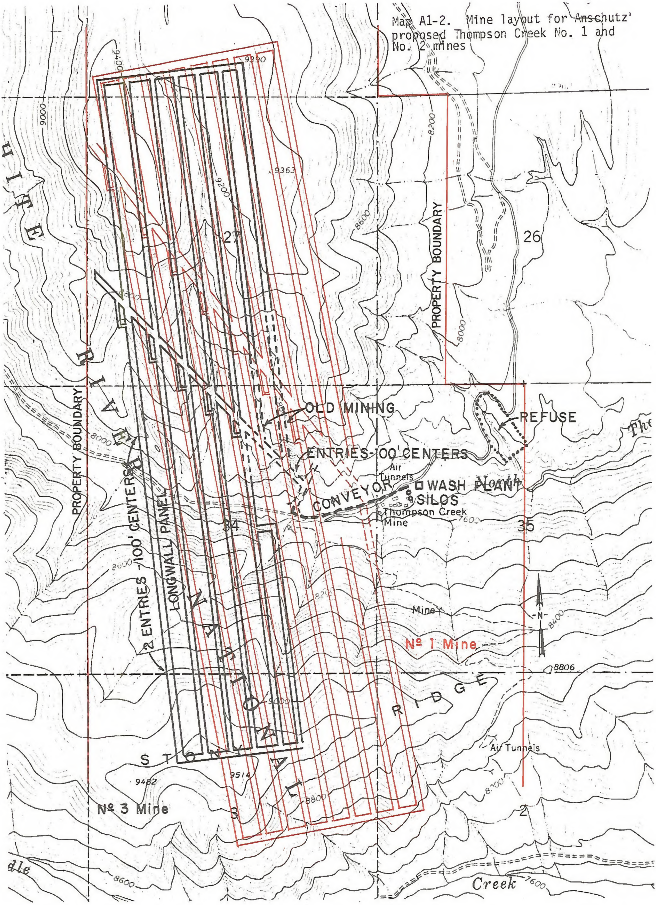
Coal would be brought to the surface by a belt conveyor.

Surface Facilities

All surface facilities are located on private land on North Thompson Creek (see map A1-2). The company estimates that under the previous operation (see History and Background) 46.48 acres were disturbed. Under the existing development operation 45.7 acres of this old disturbance are being used, leaving 0.78 acre of the previously disturbed area as yet unused or unreclaimed. Anschutz says that the operation's refuse area encom-

Figure A1-1. Looking north at the North Thompson Creek No. 1 and No. 3 mines. Currently, the coal is hauled by truck approximately 13 miles to rail loadout facilities at Carbondale, Colorado. Kmv indicates the coal bearing Mesaverde formation, Kmvr the Rollins sandstone member of the Mesaverde, and Km the Mancos shale. Coal beds in the area dip at an angle of 27 to 30 degrees. The distance from A to A' is approximately 1 mile.

Map A1-2. Mine layout for Anschutz' proposed Thompson Creek No. 1 and No. 2 mines



passes 10.17 acres; sediment ponds at the toe of the refuse piles use 0.37 acre; portal area No. 1 uses 0.32 acre; portal area No. 3 uses 0.21 acre; all the offices and buildings occupy 0.56 acre; two slurry ponds take up 0.81 acre; three sewage ponds use 0.21 acre; and the remaining acreage is used for coal storage and other unspecified purposes. The office and shop is in a 16,000-square-foot building located near the preparation plant. Other buildings would be needed for the operation, but no details were given in the plan. Most of the washing facilities are in an existing enclosed building.

SURFACE HAULAGE SYSTEMS

The coal from the No. 3 Mine would be transported from the portal to a surge bin by a 0.5-mile, covered conveyor. From the surge bin, the coal would be transported to a 2,000-ton, raw-coal storage silo by a covered overland conveyor. Coal from the No. 1 Mine belt conveyor would be deposited directly into the surge bin. The clean coal would be transferred to a 2,000-ton, clean-coal storage bin from which the coal would be loaded into 30-ton capacity tractor-trailers for haulage 12 miles to a railroad siding at Carbondale. Projected truck traffic over a five-year period is given in table A1-2. Anschutz presently hauls coal from private production at the site over a county road with vehicles adhering to speed limits imposed in cooperation with Pitkin County.

All transfer points on the overland conveyor and at the rotary breaker would be sprayed with water. A dust collecting device would be placed on the raw-coal bin to control dust if it develops. After leaving the washing plant, the clean coal would contain an estimated 7 percent moisture. If dust problems develop at the truck loadout, additional water spraying would be added. In truck haulage, the top of the coal would be treated with water and dust retardants, or the trailer unit would be covered to prevent fugitive dust. Road dust would be controlled by either spraying the road with water or treating it with a dust retardant. Permits for dust emission have been obtained from the state of Colorado.

REFUSE DISPOSAL

During the proposed 30-year mine life, approximately 97,680 cubic yards of refuse from the operation would have to be disposed of annually. The refuse disposal site would occupy approximately 10.17 acres and would be used for approximately 15 years. Other areas may be considered for future refuse disposal if needed after the 15-year period.

Refuse would consist of coarse waste from the mine and waste that is up to 0.25 millimeter in size from the wash plant. The coarse waste would be stored at the portal and trucked to the disposal site periodically as necessary. The wash-plant waste would be pumped as a slurry to the settling ponds. The settling ponds would be cleaned periodically as necessary, and the solid material would then be trucked to the disposal site.

The waste material would be spread over the disposal area in 2-foot thick layers, and the coarse and fine material would be thoroughly mixed by a large track-type unit equipped with a ripper tooth. The unit would then be used to compact the layers until a height of 8 feet is reached; this would constitute one lift of waste disposal. The next lift would then be recessed 5 feet back from the lower lift edge. When the area is full, it would be graded to approximately its original contour, covered with topsoil, and planted with recommended vegetative cover in conformance with all regulations. A sediment retention pond would be constructed in the drainage below the refuse pile to catch and retain any material washed from the pile by runoff.

Combustible material from the operation, consisting of timber from the mine, rock-dust bags, etc., would be disposed of properly. Material other than timber would be disposed of in a sanitary land-fill.

DRAINAGE SYSTEM

Anschutz has designed a drainage plan for the mine site that will have to be brought into compliance with federal regulations in 30(CFR): 717 before the mining and reclamation plan can be approved. The following is a description of this existing proposal.

The drainage plan for the area above the mining site would consist of a series of five detention ponds along the segment of the access road that runs from the refuse disposal area to the mine. A pond would be located at each intersection of the road and a natural water drainage. Each pond would be constructed to withhold all runoff water generated by a 25-year frequency storm.

In the event of a storm larger than a 25-year storm, a system of culverts and ditches would drain excess water from the ponds to the slurry ponds, which would double as a backup detention storage area. The on-site drainage system would consist of a series of terraces, which are sloped back toward a ditch located at the toe of the next highest terrace. This ditch system is designed to channel runoff water from the 5-year frequency storm to the slurry retention ponds. All flood waters retained in these ponds would then be allowed to evaporate or infiltrate into the subsurface soil mantle.

Anschutz has prepared the facility site by leveling the flood plain area north of Thompson Creek and using previous coal spoil as fill. They intend to protect the fill slopes from 100-year floods by securing the spoil fill with at least 6-inch-diameter riprap. Although not specified in the plan, the riprap is most likely to be obtained off-site.

Water Supply System

The total operation at designed production would consume an estimated 54 million gallons of water per year (194 acre-feet per year). At present, approximately 107,000 gallons of water per day (93.75 acre-feet per year) are pumped from the mine and used in the wash plant. All additional water encountered in the mine would also be used in the washing plant; none would be discharged into the existing water courses. The remaining water needed for operations would be taken out of North Thompson Creek.

Road System

The mine area is at the terminus of a county road, 12 miles from Carbondale. Traffic to and through the area is controlled, particularly when coal trucks are operating. The road would be improved according to an agreement between Anschutz and Pitkin County. Over a four-year period the program would include:

Year 1. Widening, grading, ditching, and gravel surfacing

Year 2. Aligning, widening, ditching, and gravel surfacing as required

Year 3. Improving road to specified standards

Year 4. Oil and chip surfacing to eliminate dust

In addition to the truck traffic projected in table A1-2, there would be traffic resulting from employee travel to and from the mine site, as shown in table A1-3.

Power Facilities

Power facilities for the Thompson Creek mines are already on the property, constructed by the previous mining operation. No additional construction of power lines is contemplated at present.

Surface Reclamation

As a condition of issuance of a special-use permit, Pitkin County required Anschutz to reclaim those areas disturbed by previous coal mining operations and such new construction areas as have been completed. A revegetation plan was submitted to Pitkin County, and the company has begun reclamation. Disturbed areas are graded to approximately their original contour, an agronomy blanket is placed on them, and then they are planted with the recommended vegetative cover.

Anschutz removes and stores topsoil which will be used to cover the refuse pile periodically as a seal and to terrace coal refuse dump before revegetation. With few exceptions, soil has not been stockpiled from previous operations. Anschutz plans to add new topsoil to banks left from previous operations which are unusually steep or have a high percentage of coal spoil.

In those locations where construction has been completed, Anschutz has graded all banks to approximately a 30-degree slope where physically possible. Certain stream bank areas and others too rocky for gradual sloping have not been graded. Grading, back-filling, and contouring have proceeded in three phases to coincide with the revegetation program. Phase 1 was completed in October 1976 and phase 2 in October 1977; phase 3 is scheduled to be finished in October 1978. In addition, Anschutz obtained a mined land reclamaion permit from the state of Colorado for their operations in January of 1978.

The Anschutz North Thompson Creek No. 1 and No. 3 mining operations will be required to reclaim all disturbed lands to a condition capable of supporting the prior land use before mining commenced, or to a land use of higher or better condition. A mining permit will not be approved until the applicant has demonstrated that the reclamation plan contained in the mining and reclamation plan can restore the land areas affected to the proposed post mine land use.

Authorizing Actions

This mining and reclamation plan was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Section 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87). Therefore, this plan does not fully reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the plan was designed using the requirements of the initial regulations. Before the plan is approved by the Department of the Interior, it will be returned to the mining company for redesign to incorporate the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations at 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is governed by the regulation 30(CFR): 715.15. The standards and measures described in these regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

TABLE A1-1

EQUIPMENT TO BE USED IN EACH MINE

Number	Equipment
4	Alpine mines with roof bolter attached
4	Retractable conveyors
12	Bottom-dump mine cars
1	12-ton locomotive
80	350-ton chocks
1	Double-drum shearing machine
1	Armored chain conveyor
1	Breaker-stage loader
1	Entry conveyor belt
1	Slope conveyor belt

TABLE A1-2

PROJECTED COAL HAULAGE SCHEDULE

Year	Tons of Coal/Day	Truck Loads of Coal/Day
1978	700	24
1979	1,980	66
1980	4,270	143
1985	4,270	143
1990	4,270	143

TABLE A1-3

EMPLOYEE VEHICLE TRIPS

Year	Number of Employees	Daily No. of Cars Per Production Shift
1978	80	16
1979	160	32
1980	320	64
1985	320	64
1990	320	64

Federal Requirements

Before mining could begin on the federal lease acres, the USFS would have to concur with the USGS and the OSM in the approval of the mining and reclamation plan.

State and County

Anschutz has obtained the necessary air quality, water quality, and mining permits required by the state of Colorado because they are presently mining on their private lands. Unless changes occur in their proposal, they would require no additional state permits from the Colorado Department of Natural Resources. Anschutz would have to obtain ground water rights for their proposed usage of mine water from the Colorado State Engineer. Anschutz has obtained necessary permits from Pitkin County.

Interrelationships

Relationship to Other Present and Potential Actions

Mid-Continent Coal and Coke Company is presently the only other operator actively mining coal in the general area. The company operates the following mines in Coal Basin: Bear Creek Mine, Coal Basin Mine, Dutch Creek No. 1 Mine, Dutch Creek No. 2 Mine, and L.S. Wood Mine. All of these mines are located 5 miles west of Redstone, Colorado, and 8 miles southwest of the proposed Anschutz operation (see map 1 in appendix A). Coal from both operations is trucked to Denver and Rio Grande Western Railroad loadout facilities in Carbondale.

U.S. Steel Corporation holds eight inactive coal leases in the general area. In addition, Thompson Creek, Garland Coal Company, and Mid-Continent Coal and Coke Company each hold one inactive federal lease. (Map 1 in appendix A shows the location of these leases in relation to the Anschutz operation.) In general, the coal reserves on these leases are considered to be under a minimum of 2,000 feet of overburden. No activity is currently projected for these leases, but diligent development and continuous operations requirements will require these leases to be developed before 1986.

Exploration for natural gas is in progress approximately 3 to 6 miles west of the Thompson Creek mines. In addition, Rocky Mountain Natural Gas Company uses old gas wells approximately 4 miles west of the mines as storage reservoirs. The gas is used during peak periods from November to April. (Map 1 in appendix A shows the position of the existing leases and gas transmission lines.)

Relationship to U.S. Forest Service Plans

The national forest systems land included in the mining and reclamation plan is administered by the White River National Forest. It is subject to specific guidelines in the Draft Environmental Statement: Thompson Creek Land Use Plan (U.S. Department of Agriculture 1976).

The area leased by Anschutz has been used for livestock grazing, wildlife habitat, fisheries habitat, timber production, watershed, and recreation such as hunting, fishing, and hiking. As explained in History and Background, the Thompson Creek area has a history of coal mining activity dating back to the late 1800s.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, cultural resources, and the socioeconomic conditions which contitute the site-specific environment in which Anschutz Coal Corporation proposes to develop federal coal and adjacent private coal. The description focuses on environmental details most likely to be affected by Anschutz' proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunderstorms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air movements.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Thompson Creek mine site is located in a remote mountainous area of the White River National Forest. The site is south of North Thompson Creek at an elevation of 7,400 feet. Temperatures at the site average 39 degrees Fahrenheit annually. Annual precipitation is about 11 inches per year. The growing season is only 45 days (based on 32 degree freeze threshold data). Evaporation is estimated to be about 45 inches annually.

Winds are assumed to be from the west and to follow an up valley- down valley orientation along North Thompson Creek with an average speed of 8 miles per hour (figure A2-A). No on-site data are available; data from Grand Junction weather station were utilized and adjusted to fit the profile of the valley for this proposed site.

Air Quality

Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations range from 20 to 40 $\mu g/m^3$.

The available particulate sampling data which best represent existing particulate air quality at the proposed Thompson Creek mine are from three sampling sites located in remote mountainous areas of west-central Colorado. The annual geometric mean concentrations recorded at these sites range from 20 to 29 $\mu g/m^3$. Thompson Creek mine is already in operation on private land, and the proposed development of this site specific is an expansion of this operation onto federal land. Thus, existing particulate air quality at this site is background concentration (20 to 29 $\mu g/m^3$) plus the impact from the operating mine.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutants near the proposed site. Since no major sources of these pollutants exist in the surrounding area, concentrations are considered to be at background or natural levels.

Visibility at the site ranges from less than 1 mile to approximately 100 miles throughout the year. Average visibility is about 54 miles, with greatest visibility occurring during spring and summer months.

Geologic and Geographic Setting

Topography

The proposed site of the Thompson Creek No. 1 and No. 3 mines is about 13 miles west of the Roaring Fork River and the Roaring Fork Creek Valley. The site lies astride North Thompson Creek, which flows east through the lease area. (See map A1-1 in chapter 1.)

The major ridge system in the area lies west of the Anschutz leases. It trends east-west, and its

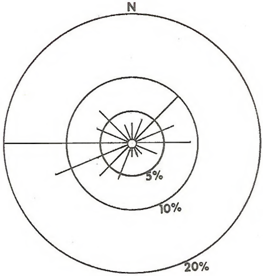


Figure A2-A. Annual wind frequency at the Thompson Creek mine site

highest peaks approach 11,000 feet. The lease area lies on the lower, eastern slopes of this ridge system. Slopes face predominantly north or south; however, in the northeast corner the dominant slope direction is east at the very toe of the slope. Elevation in the lease area ranges from 9,514 feet along Stony Ridge to 7,360 feet along North Thompson Creek. Slopes range from 72 percent to 4 percent along North Thompson Creek; the average slope is about 30 percent.

Anschutz currently uses the 10-acre refuse disposal area (map A1-2) for the company's operations on private coal leases. The site shows signs of historical use as a dump area. Slopes in the area vary from 40 percent (south-facing slopes) to 60 percent (north-facing slopes) with some short steeper sections.

Landforms

The landforms on the lease area have been formed by the differing rates at which the geologic formations and structures have eroded. High ridges (such as Stony Ridge) define the drainage basis, and the valleys are narrow and V-shaped. Alluvial floodplain deposits are narrowly confined to the valleys.

Structure

The North Thompson Creek property lies along the southern end of the Grand Monocline. Most of the coal beds on the lease area dip westward 30 degrees to 35 degrees unless deflected by smaller local structures.

A west-trending anticline underlies the divide between Middle Thompson and North Thompson creeks just west of the lease area. It breaks the regional syncline into two synclinal structures. On the southern side, the coal beds along and north of Lake Ridge dip westward from the outcrop to a north-plunging syncline. The other plunging syncline trends northeasterly to west from the south end of the property toward the South Branch of Middle Thompson Creek. It adjoins the north flank of the Coal Basin anticlinal dome where the coal beds dip northward toward the syncline. There are no major faults in the area of the North Thompson Creek No. 1 and No. 3 mines, although there are a few relatively minor faults with displacements of a few inches to several feet. These minor faults affect mine planning but are not severe obstacles to the mining of the coal.

Stratigraphy

The exposed stratigraphic sequence on the North Thompson Creek property is of Upper Cretaceous and Tertiary ages. In ascending order (that is, oldest to youngest) outcropping formations are the Upper Cretaceous Mancos shale and Mesaverde formations, the Tertiary Ohio Creek and Wasatch formations, and the Tertiary volcanic conglomerates.

In the lease area the Mancos shale occupies the lowest topographic positions, lying at the bottom of major stream channels such as North Thompson Creek. The Mancos in the area consists of soft gray marine shales with total thickness of 4,000 feet.

The Mesaverde formation is overlain by the Ohio Creek and Wasatch formations. The contact between the Mesaverde and the overlying Ohio Creek conglomerate is a regional low-angle unconformity. Remnants of volcanic conglomerates are irregularly distributed over the Wasatch along Stony Ridge and in the headwaters of Middle Thompson Creek.

The Mesaverde formation conformably overlies the Mancos shale. in this area, the Mesaverde consists of the following four members in ascending order: the Rollins sandstone member, the Bowie shale member, the Paonia shale member, and the upper (or barren) member. The economically mineable coal beds are located in the 850-foot Bowie member and the 600-foot Paonia member of the Mesaverde formation. The lower 125 feet of the Bowie member contain three coal seams: A, B, and C (in ascending order). The Paonia member contains up to five irregularly distributed coal seams: Sunshine, Anderson, Lake Ridge, Thompson, and Stony Ridge (in ascending order). Table A2-1 lists the seams in each member, their thickness, and their distance apart. Figure A2-1 is a schematic of the coal seams at the Anschutz mines.

Coal beds considered by the U.S. Geological Survey (USGS) to be of commercial thickness are restricted to the Bowie shale member (A and B seams) and Paonia shale member (Anderson and Sunshine seams). Anschutz consideres only the A and Anderson seams to be of commercial thickness at this time. (See Mineral Resources for further discussion.)

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be considered in the ES process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table A2-2. Due to the present lack of data and accepted criteria for determining significance, the importance of these paleontological resources to science, education, and other values cannot presently be assessed.

TABLE A2-1

COAL SEAMS ON PROPOSED ANSCHUTZ LEASE AREA

Coal Seams in Descending Order	Thickness (feet)	Height above Next Lower Seam (feet)
Paonia Member:		
Stony Ridge	3.60 to 5.10	50
Thompson	4.00 to 5.00	20 to 140
Lake Ridge	4.00 to 7.00	10 to 40
Anderson	8.00 to 10.00	60
Sunshine	2.00 to 6.00	--
Bowie Member:		
C	+2.00	25 to 50
B	4.70 to 5.75	30 to 40
A	7.00 to 10.00	--

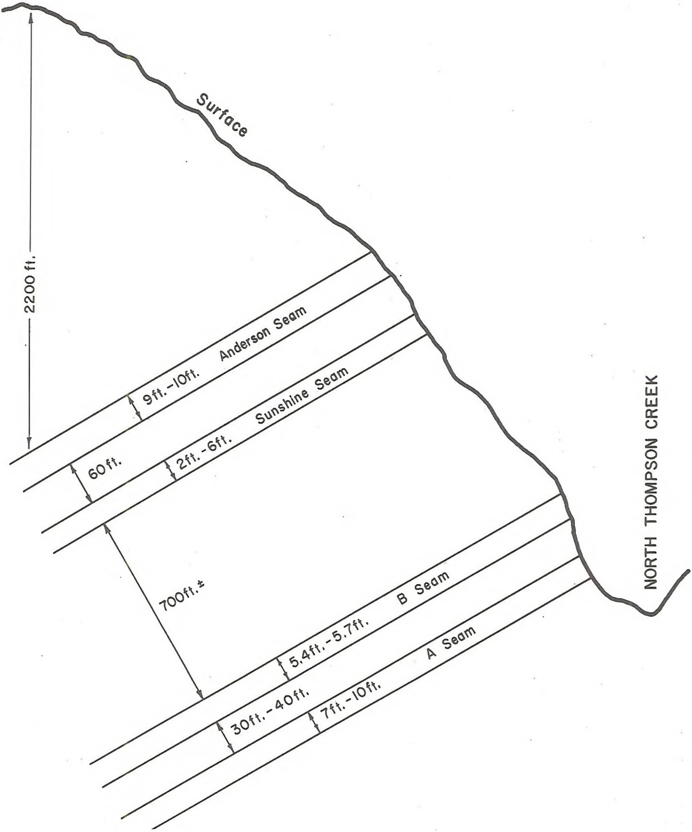


Figure A2-1. Schematic of coal seams at the proposed Thompson Creek No. 1 and No. 3 mines

TABLE A2-2

SUMMARY OF FOSSIL-BEARING FORMATIONS IN THE AREA OF THE PROPOSED ANSCHUTZ MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils
Maroon	Triassic	General	V, I, P
Entrada	Jurassic	General	V, I, P
Morrison	Jurassic	General	V, I, P
Dakota	Late Cretaceous	General	V, I, P
Mancos	Late Cretaceous	General	V, I, P
Mesaverde	Late Cretaceous	General	V, I, P
Ruby	Tertiary	General	V, I, P

a/General = Formation contains fossils throughout; specific localities are not identified.

I = invertebrate; V = vertebrate; P = paleobotanical.

The BLM and USGS are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

Mineral Resources

Coal

Anschutz proposes to mine the A seam through the Thompson Creek No. 1 mine and the Anderson seam through the Thompson Creek No. 3. mine. The two seams are 800 feet apart stratigraphically. Overburden in the mining area will vary from 0 feet at the outcrop of the Anderson and A seams, to a minimum of 1,500 feet over the Anderson seam at the east boundary of lease C-08173, to over 3,000 feet over the Anderson seam at the west boundary of the lease. The company considers the other coal seams uneconomical to recover at this time.

The company estimates that 33 million tons of coal would be recovered from the Thompson Creek No. 1 and No. 3 mines under the mining and reclamation plan: 12.5 million tons from the No. 3 Mine, 5 million tons from the No. 1 Mine from lease C-08173, and 15.5 million tons from the No. 1 mine from private coal. The A seam is 7 feet thick in the area of the proposed project with a proximate analysis of 12,640 BTUs, 0.90 percent sulfur, 16.4 percent ash, 2.1 percent moisture, 60.6 percent fixed carbon, and 33.65 percent volatile matter. Coal from this seam has been used successfully as a blending coal in the manufacture of high temperature metallurgical coke. The Anderson seam is 10 feet thick with a proximate analysis of 13,745 BTUs, 0.90 percent sulfur, 7.85 percent ash, 2.95 percent moisture, 58.5 percent fixed carbon, and 30.56 percent volatile matter.

Oil and Gas

There is little potential for oil and gas under the proposed project area. The Wolf Creek gas field, located approximately 4 miles west of the area, is used primarily for gas storage by the Rocky Mountain Natural Gas Company.

Water Resources

Surface Water

The Anschutz complex is situated within the Thompson Creek subdrainage, a tributary to the Crystal River. (The Crystal River and the Roaring Fork subbasin are described in chapter 2 of the regional volume.) The Thompson Creek subdrainage is an area of approximately 76 square miles, producing an estimated average annual discharge of 31,650 acre-feet. The Anschutz complex is located on North Thompson Creek about 7 miles upstream from its confluence with the Crystal River. Records from a USGS gauging station (No. 09082800), located on North Thompson Creek 2.2 miles upstream from the mining site, show that the average annual discharge is 12,610 acre-feet, or 17.4 cubic feet per second (cfs). A maximum discharge rate of 365 cfs was recorded on May 22, 1970, with a minimum flow of 0.09 cfs occurring on September 6 and 7, 1967. Spring snowmelt has produced peak flows as high as 272 cfs (May 20, 1970). However, the average daily flow rate for the month of May is 92 cfs, and for the month of June, 64 cfs. Stream flow between August and April is generally less than 5 cfs, with flow of less than 2 cfs being common. In extremely dry years, the flow rate falls below 1 cfs. It is assumed that the flow is greater in the vicinity of the Anschutz complex since it is downstream from the USGS gauging station.

Anschutz is not currently using any water from North Thompson Creek. However, the company has absolute water rights for 194 acre-feet per year or 0.2684 cfs (applications number W-2980 for 0.0462 cfs and number W-2979 for 0.2222 cfs, dated March 28, 1977). All water used in support of the current operation comes from ground water obtained from the mines.

Ground Water

The best general information on ground water conditions is contained in a Colorado state geological study of the Roaring Fork and Crystal valleys (Colorado Geological Survey 1974) and a USGS reconnaissance report by Price and Arnow (1974). The occurrence of ground water in the coal-bearing Mesaverde formation and younger consolidated formations is controlled by interstitial porosity, that is, water is contained and transmitted through interconnected pore spaces between grains within the sedimentary bedrock. Although some of the older formations also exhibit interstitial porosity, it is not considered the controlling ground water feature of the older rocks.

Although there are no wells of record in this ground water province, yields would probably vary between 0 and 50 gallons per minute (gpm) and average 10 gpm. Depths to water production vary according to the area and site geology.

Anschutz is currently obtaining an average of 74 gpm (107,000 gallons per day) from within the company's mines. The quantity of ground water obtained from a mining operation varies greatly from season to season. The Anschutz operation has obtained water yields as low as 63 gpm during the winter months. Anschutz does not have water

rights to the ground water that it is using and does not anticipate filing for this water at this time.

Water Quality

The Anschutz operation is located between two sampling sites on North Thompson Creek from which the U.S. Forest Service (USFS) has collected baseline water quality data (U.S. Department of Agriculture 1976a). The quality of North Thompson Creek can be classified as fair to poor. The water in the subdrainage is moderately hard. It is also naturally high in iron and sulfates, making it marginal for aquatic habitat (see Aquatic Biology). Table A2-3 summarizes these data.

In the recent past, the Anschutz operation has pumped excess ground water, high in dissolved solids and sulfates, directly into North Thompson Creek, increasing the stream's electrical conductivity 47 percent, total hardness 39 percent, and sulfates 604 percent. The Colorado Department of Health, in accordance with the provisions of the Federal Water Pollution Control Act (as amended, 33 USC 1251 et seq.) and the Colorado Water Quality Control Act (25-8-101 et seq.; CRS, 1973 as amended), has since placed limits on Anschutz to control the concentrations of total suspended solids, total iron, etc., that are discharged into North Thompson Creek (see table A2-4). The special discharge permit, number C-0029599, is dated August 26, 1977. Violation of these effluent limits may result in the closure of the mining operation, a fine, or both by the state of Colorado or the Environmental Protection Agency. In addition, some old, unreclaimed spoil piles and the road between the shop area and Mine No. 3 have caused a very significant increase in suspended sediments in the stream during periods of snowmelt and after thunderstorms.

The quality of ground water in the Mesaverde group can generally be expected to be of poor quality. Analysis of water throughout this aqui fer shows that excessive iron, manganese, sulfate, and fluoride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1973, Price and Arnow 1974, and Brogdon and Giles 1977). Typically the water is of poor chemical quality for domestic or public uses. Ground water data, taken from the mine shafts at Anschutz by the Colorado Department of Health in January and February 1976, are summarized in table A2-5.

Flood Hazard

Anschutz is located within the drainage bottom of North Thompson Creek. A potential exists for loss of life or property due to runoff from a 100-year storm. No existing records indicate what flow volumes might be expected from a large infrequent storm, such as the 100-year storm. However, using the Department of Agriculture's method of computing peak flows, the estimated peak flow from a 100-year/24-hour storm event, with a precipitation rate of 3 inches hour, is 3,930 cfs (figure A2-2).

Soils

Soils for the general area of proposed surface activity are mapped in figure A2-3. Individual mapping units range from very shallow soils and rock outcrops on the steep upland slopes to deep soils formed in heavy-textured alluvial deposits on lower slopes and in valleys. In addition, several areas within the mine site contain partially decomposed shale and other coal spoil material brought to the surface during previous mining operations. This material is presently eroding and will complicate reclamation efforts. Other specific soil features of importance in assessing reclamation are rated in table A2-6; brief explanations of each rating are given in the footnotes.

Vegetation

There are seven vegetation types within the coal lease area: mountain shrub, aspen, Douglas fir, spruce-fir, pinyon-juniper, sagebrush, and riparian. (See map A2-1.) Mountain shrub, which is dominated by gambel oak and serviceberry, is the most widespread type. Douglas fir and aspen grow along the North Fork of Thompson Creek near the existing Anschutz mine, and on the north-facing slope immediately south of the mine. The pinyon-juniper type occurs on dry, southern exposures in the northern part of the coal lease area and on the rocky slope south of the mine. Large sagebrush flats occur northeast of the existing mine, at elevations below 8,000 feet; big sagebrush is the dominant plant in this type. The riparian vegetation along North Thompson Creek consists mainly of Douglas fir, willows, and alder. No data are available on aquatic vegetation in the proposed lease area.

A more detailed discussion of the plant species composition of these vegetation types, as well as their relationships to climatic and topographic features and to each other, can be found in the regional analysis. Scientific names of the plants are listed in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the *Federal Register* (see table R2-10 in the regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State Uni-

TABLE A2-3

SELECTED WATER QUALITY DATA FOR NORTH THOMPSON CREEK

Parameter	Units a/	Sample Locations: NW¼NW¼SE¼ Section 28, T. 8s., R. 89W.	Sample Locations: SE¼NE¼NW¼ Section 36, T. 8S., R. 89W.
Turbidity	JTU	16.0	19.8
Electrical conductivity	micromhos	178.0	262.6
pH		--	8.4
Total alkalivity	mg/l	79.7	80.7
Total hardness	mg/l as $CaCO_3$	70.0	97.4
Calcium hardness	mg/l as $CaCO_3$	50.0	68.5
Magnesium hardness	mg/l as $CaCO_3$	16.4	29.5
Sulfate	mg/l	4.4	31.0

Source: U.S. Department of Agriculture 1976a.
a/ JUT = Jackson Turbidity Units; mg/l = milligrams per liter;
$CaCo_3$ = calcium carbonate.

TABLE A2-4

EFFLUENT LIMITS ESTABLISHED FOR ANSCHUTZ COAL OPERATION IN NORTH THOMPSON CREEK BY PITKIN COUNTY AND COLORADO DEPARTMENT OF HEALTH

Parameter	Maximum Concentration (milligrams per liter) 30-day Average	7-day Average	Daily Maximum
BOD_5 a/	30	45	NA
Total Suspended Solids a/	N/A	N/A	30
Fecal Coliforms (No./100 ml) a/	6,000	12,000	NA
Total Residual Chlorine a/	NA	NA	0.03
Total Iron a/	3.5	NA	7.00
Oil and Grease a/	NA	NA	10.00
Total Suspended Solids b/	NA	NA	30.00
Total Iron b/	3.5	NA	7.00
Oil and Grease b/	NA	NA	10.00

Note: BOD_5 = five-day biological oxygen demand.

NA = not applicable.

a/ Outfall from sewage treatment plant and Mine No. 1.

b/ Outfall from coal washing plant settling pond and Mine No. 3.

TABLE A2-5

GROUND WATER DATA FROM ANSCHUTZ MINE (COLORADO DEPARTMENT OF HEALTH, JANUARY AND FEBRUARY 1976)

Parameter	Units a/	Concentration
pH	--	7.74
Dissolved solids	mg/l	1,122.75
Electrical conductivity	micromhos	2,625.00
Alkalivity	mg/l	495.00
Hardness	mg/l as $CaCO_3$	537.50
Calcium	mg/l	115.00
Iron	micrograms/liter	0.50
Sulfate	mg/l	320.00

a/ mg/l = milligrams per liter; $CaCo_3$ = calcium carbonate.

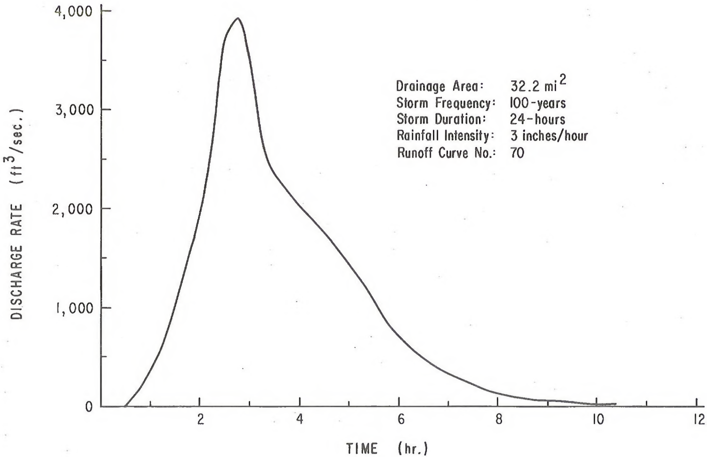
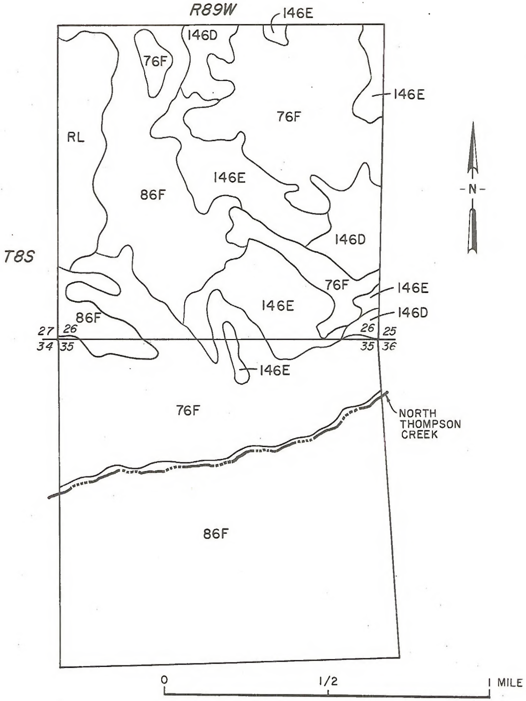


Figure A2-2. Hydrograph of the runoff in North Thompson Creek from a 100-year/ 24-hour event



76F Dollard-unnamed silty clay loam-shale outcrop, steep-very steep
86F Jerry loam, 25-65% slopes
146D Unnamed silty clay loam, 6-12% slopes
146E Unnamed silty clay loam, 12-25% slopes
RL Torriorthent-rock outcrop, 25-65+% slopes

Figure A2-3. Soil units in the area of the proposed Thompson Creek No. 1 and No. 3 mines

TABLE A2-6

SOIL FEATURES FOR ANSCHUTZ MINING AREA

Mapping Unit No. Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
76F Dollard-Unnamed-Shale outcrop complex				
Dollard	D	Poor	High	Severe
Unnamed silty clay loam	C	Fair	High	Severe
Shale outcrop	-	-	-	-
86F Jerry loam	C	Poor	Moderate	Moderate
146D Unnamed silty clay loam	C	Fair	Moderate	Moderate
146E Unnamed silty clay loam	C	Fair	Moderate	Moderate
RL Torriorthent-Rock outcrop				
Torriorthents	D	Poor	High	Severe
Rock outcrop	-	-	-	-

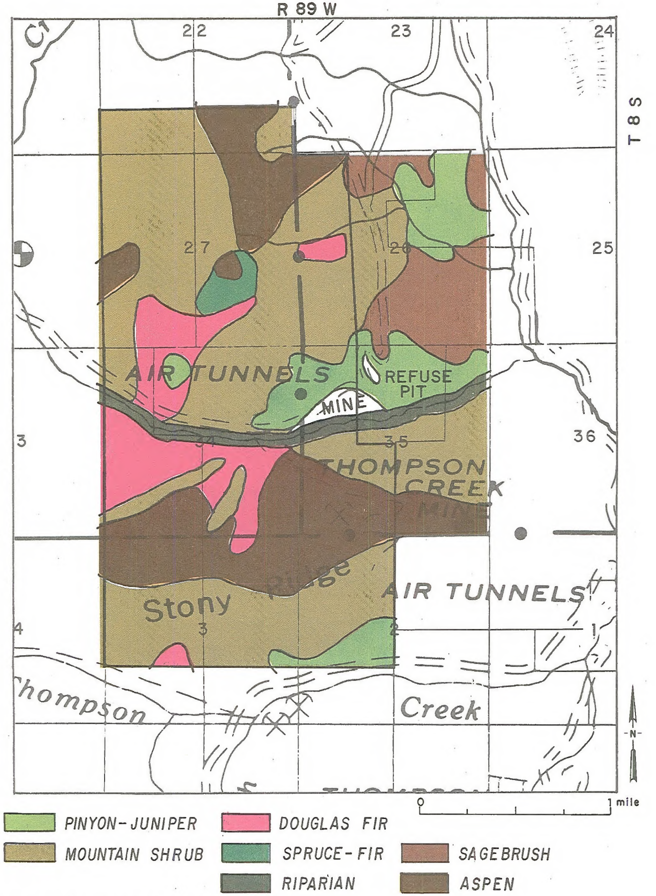
Source: Adapted from data compiled by the U.S. Department of Agriculture, Soil Conservation Service (Glenwood Springs, Colorado), for the Aspen-Gypsum Area Soil Survey (unpublished).

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic conditions which produce extreme surface erosion or landslide hazards.



Map A2-1. Vegetative types in the area of the proposed Thompson Creek No. 1 and No. 2 mines

versity, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Thompson Creek Mine. The results of the literature and herbarium studies may be seen at the BLM Montrose District Office. No on-the-ground floristic or endangered and threatened plant inventory has been conducted in the area of the Thompson Creek Mine, since no additional surface disturbance will occur.

Wildlife

In the U.S. Forest Service (USFS) draft Thompson Creek Land Use Plan (1976a), which includes the Anschutz lease area, protection of summer big game habitat is a critical element in the alternative selected for management of the area. Existing and new roads will be closed, and public access will be restricted in the middle and south branches of Thompson Creek. Timber harvest will enhance big game forage.

The mine portals and the coal washing and loading facilities have already been constructed and are in operation. This portal area is no longer used by the larger, more mobile species, such as deer, elk, black bear, and coyotes. Smaller animals' use of the area has been curtailed, although there have been some population increases among species closely associated with human beings. All terrestrial fauna species known or expected to occur in the Thompson Creek area are listed in appendix C.

Big Game

MULE DEER

Mule deer are found throughout the area, most of which is summer range. There is also winter range to the north, but crucial winter range is generally below the Anschutz lease area. (See map A2-2.) Winter range is considered to be the limiting season of the year because the land area, forage, and water distribution are considered inferior to those found on summer range. The use on winter range indicates how the summer range is used: levels of use vary from 14 to 23 deer days per acre, with crucial areas receiving as high as 59 deer days per acre. Current mine operations have taken 46 acres, which would have supported 6 deer.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average numbers. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer population within the Anschutz lease area of about 235 animals during the winter months.

ELK

Elk occur throughout the area, which has both summer and winter ranges (map A2-2). There are a number of crucial winter concentration or calving areas. Calving areas are particularly important because they have been selected over time and offer the best combination of food, water, cover, seclusion, and aspect for calving. Colorado Division of Wildlife (DOW) transects from 1969 to 1977 indicate an average of 23 elk days per acre around the lease tract. Current mine operations have taken 46 acres, which would have supported eighteen elk.

Elk winter population estimates in the Anschutz area indicate about 8 elk per square mile. This would result in about 32 elk inhabiting the site during an average winter.

BLACK BEAR AND MOUNTAIN LION

Black bear occur throughout the lease area, particularly in the mountain shrub, spruce-fir, and aspen habitat types. Mountain lion, although not particularly common, occasionally occur in the lease area.

Small Mammals

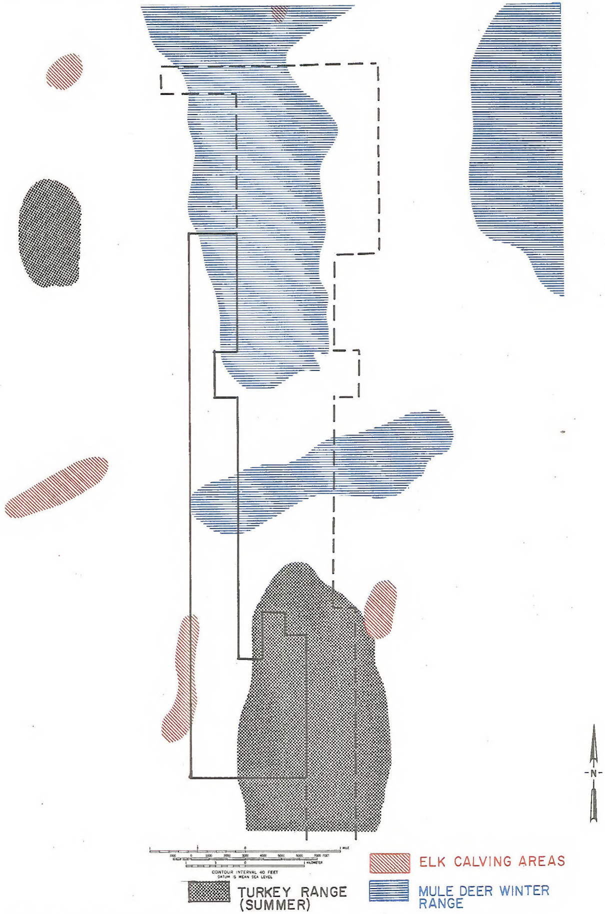
There is a great variety of small mammals on the area. Beaver and raccoon occur along most of the small streams. The beaver utilize willow and aspen for food and dam materials. Red squirrels, voles, snowshoe hares, and martens can be found in the dense spruce-fir forest. In the mountain shrub habitat at lower elevation, Colorado and least chipmunks, cottontail rabbits, rock squirrels, and deer mice commonly occur.

Small mammals are occasionally considered pests, damaging buildings, crops, and native vegetation, and they may be carriers of disease. At other times, many of these same small species provide entertainment for visitors and residents. Overall, this group is important for its place in the food chain.

Game Birds

Four species of game birds occur regularly on the lease area: turkey, mourning dove, bandtailed pigeon, and blue grouse. (A fifth game species, the white-tailed ptarmigan, may occur on alpine habitat in the southwest portion of the area.)

In 1973, a winter population of 75 turkeys was estimated for the Crystal River drainage in Pitkin County (Quantenback 1974). Several regular summering areas have been identified (map A2-2), although turkey can be found almost anywhere within mountain shrub, meadow, or aspen habitat types. Winter is considered the most critical time for turkey in the area; not only are food, grit, and



Map A2-2. Wildlife habitat in the area of the proposed Thompson Creek No. 1 and No. 2 mines: deer, elk, and turkey

cover less abundant, but fewer roost trees are available.

The mourning dove and band-tailed pigeon are migratory species not present in the winter. During the summer nesting season, the mourning dove is most common at lower elevations in the pinyon-juniper and sagebrush types. The band-tailed pigeon is found at the high elevations in the spruce-fir and aspen types. Blue grouse occur throughout the area, utilizing all types for at least part of the year. The most crucial types for blue grouse are riparian and mountain shrub, which they utilize for brood rearing.

Waterfowl use is limited by the small amount of open water in the area. Ducks, primarily mallards, occur along the larger streams, lakes, and ponds. North and Middle Thompson creeks and Lake Ridge lakes are the primary areas of waterfowl use.

Other Birds

Bird species associated with the spruce-fir and aspen habitat types are common to the area. Raptors most commonly found are tree nesters and include the kestrel, red-tailed hawk, Coopers hawk, goshawk, and several species of owl.

Amphibians and Reptiles

Amphibians and reptiles are not numerous in this area, because cold- blooded species are not tolerant of the generally cool temperatures. The tiger salamander, leopard frog, chorus frog, and several species of toad are found near water. The most common snakes are the gopher and wandering garter snakes; the most common lizards are the eastern fence and plateau lizards.

Endangered or Threatened Species

No state or federally listed threatened or endangered terrestrial species are known to occur in the mine area. However, the cliffs along the Crystal River near Redstone and the surrounding area contain the essential habitat components for peregrine falcon. Presently there is no evidence that peregrines are in this area, although it is thought that peregrines probably nested there in the past. If these cliffs become reoccupied, the open meadow and park on the lease area would be well within the normal hunting range of peregrines. Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle.

Aquatic Biology

North Thompson Creek crosses 0.25 mile of national forest systems lands and 0.75 mile of private land within the lease area. Below the lease area, the stream flows through 1 mile of private land and 4 miles of public land to the confluence with the Crystal River. All of the Anschutz Mine facilities lie along the stream on the private land within the lease area. The facilities which are in a position to impact the stream in this section include mine portals, roads, water treatment facilities, a coal washing plant, sediment and sewage ponds, and a refuse disposal area.

Before 1970, ground water from the mines and coal refuse were dumped directly into the stream, causing extensive degradation of the aquatic habitat. The mines were shut down for several years, and when they were reopened in 1975, large amounts of ground water high in iron, total dissolved solids, and sulfate were pumped from the mines into the stream, again degrading the habitat. In 1975, studies of aquatic insects by the BLM indicated that a large decrease in species and population numbers had occurred due to mining operations. Since the reopening, the mines have been pumped out, and a decrease in the volume of mine water discharged has resulted.

Since the development of a site drainage plan, a sewage treatment system, and a series of detention and evaporation ponds, the impact on the stream habitat has changed considerably. Presently the mine water is discharged to North Thompson Creek under a National Pollution Discharge Elimination System permit authorized by the Environmental Protection Agency and the Colorado Water Quality Control Division. Outfall serial number 002 discharges water from Mine No. 3, outfall 003 discharges from the coal washing plant and the site drainage system via the settling pond overflow, and outfall 004 discharges from the sewage treatment lagoon overflow and Mine No. 1.

Under natural conditions, North Thompson Creek approaches the maximum tolerable conditions for cold-water fish species such as trout. Low flows, high temperatures, high pH, concentrations of dissolved solids, and habitat scouring by spring runoff all contribute to a fragile aquatic ecosystem, which presently supports rainbow, brook, and cutthroat trout. Mayfly, stonefly, caddisfly, beetle, and cranefly nymphs make up the majority of the aquatic insect populations. They occurred at a density of 62 per square foot in October 1977. Sculpin, dace, and suckers are also found in the stream. The stream is stocked annually by the DOW with 800 catchable-sized rainbow trout. Access to the stream is well developed, and it receives approximately 300 angler days of use annually.

As discussed in Water Resources, the North Thompson Creek flow shows a pattern of less than 2 cfs from mid-August to mid-March. The flow for the month of September is historically less than 1 cfs, and one period of 0.09 cfs flow occurred in

September 1967. This low flow makes the aquatic organisms extremely vulnerable to variations in water quality during certain months.

The 4 miles of stream on BLM land below the mine are included in BLM's proposed Thompson Creek Natural Environment Area, and thus mainte nance of the aquatic habitat is especially important. Anglers in this area catch cutthroat, rainbow, and brook trout. DOW has recommended a minimum stream flow of 7 cfs from May to September and 3 cfs from October to April for maintenance of fisheries.

The Crystal River is the receiving water for Thompson Creek. It is one of Colorado's major stream fisheries, providing excellent trout habitat below the confluence with Thompson Creek (that portion affected by discharges from the Anschutz Mine). The stream is privately owned in this reach, but public access is generally permitted. Summer flow ranges from 80 to 100 cfs, and habitat is optimum. The DOW stocks 20,000 catchable-sized rainbow trout annually in this portion of stream. Fish species include rainbow, cutthroat, brown, and brook trout, whitefish, sculpin and dace. The numbers and diversity of aquatic invertebrates sampled in this stream indicate that the aquatic environment is healthy and unstressed.

Endangered or Threatened Species

There are no endangered or threatened aquatic species in the Anschutz mine area watersheds.

Cultural Resources

Archeology

No inventory has been conducted on the lease area because no additional surface disturbing activities will take place on this land; therefore, no archeological sites have been identified. However, archeological sites have been sited in the surrounding vicinity, indicating prehistoric use in the area. Should surface-disturbing activities be planned on federally leased land or on private land areas which have not been previously disturbed, compliance procedures as outlined in the Historic Preservation Act of 1966, as amended, in accordance with 36(CFR): 800, or as arranged as a concurrence of approval, with Anschutz, will be carried out prior to the approval of any dirt-moving procedures.

Historical Resources

Historical research by Athearn (1977) revealed no historical sites on project area lands. However, several historic properties are known to be in the general area of the proposed action: the Coke Ovens at Marion Gulch (Union Mine), the cemetary at Marion Gulch, and portions of the Aspen and Western Railroad railbed running from Thompson Creek toward Glenwood Springs. These sites were recorded in 1977 (Athearn 1977). With the exception of the cemetary, these sites all appear to qualify for the National Register of Historic Places (36(CFR): 800.10).

Transportation

Highways

The major highway nearest to the proposed Anschutz mine is State Highway 82, which links Glenwood Springs, Carbondale, and Aspen. State Highway 133 is south of Carbondale and crosses McClure pass into the North Fork Valley. The Anschutz mine is located 12 miles southwest of Carbondale on a county road. This road is classed as a primitive road by Pitkin County, but it has been much upgraded to accommodate coal trucks. Trucks with 30-ton capacity trailers are used to transport the coal from the preparation plant at the mine to a rail loading facility near Carbondale. (See figure A2-4.)

Railroads

A branch line of the Denver and Rio Grande Western Railroad running from Glenwood Springs to Aspen is the closest rail facility to the mine. Coal is trucked to loading facilities near Carbondale and shipped from the area in unit trains. Two unit trains per week will be necessary to move the coal. (See figure A2-5.)

Airports

There are several small airports near the Anschutz mine. Sardy Field near Aspen is the closest commercial airport. It is served by Aspen and Rocky Mountain Airways. Private flights are also served by airports in Carbondale and Glenwood Springs. Walker Field near Grand Junction is the major airport in western Colorado, but it is over 100 miles from the mine.

Livestock

Cattle are the primary class of livestock grazed on the coal lease area, although some horses and sheep are also grazed. The USFS portion of the allotment produces 350 animal unit months (AUMs), with 290 AUMs designated for cattle, 50 for horses, and 10 for sheep. This is less than the potential of 432 AUMs because some areas are inaccessible and some forage is unsuitable for livestock. The 2,800 acres of private land within the Anschutz lease area are also used primarily for cattle grazing; they provide 196 AUMs (actual use). The range condition and forage value of the private land are approximately equivalent to that of the adjacent USFS land. In all, 280 AUMs are produced annually on the 4,000 acres within the proposed mine area.

Figure A2-4

Figure A2-5

Coal from Anschutz' mine is trucked to temporary rail loadout facilities at Carbondale.

Recreation

The Anschutz lease site includes 1,200 acres of the White River National Forest. Although there are no recreational facilities in the proposed mining area, the lease area is suitable for dispersed activities, such as hunting, fishing, and hiking. Game species, such as elk, mule deer, blue grouse, and cottontail rabbit, provide opportunities for hunting and viewing. (Refer to the wildlife section of this chapter for the extent of the resource.) The lease site is located within Big Game Management Unit 43, which provided 14,252 hunter days of recreation in 1976, and Small Game Management Unit 54, which provided 21,914 hunter days in 1977; tables A2-7 and A2-8 provide a further breakdown of hunter use.

As discussed in Aquatic Biology, North Thompson Creek has native brook and rainbow trout populations and is stocked by the DOW with 800 catchable-sized rainbow trout each year. Fishing on North Thompson Creek provides 300 angler days annually.

Through its roadless area review and evaluation (RARE II) program, the USFS has identified a roadless area adjacent to the proposed mining area, overlapping part of the lease that is not presently proposed for development (see map A2-3). The USFS has recommended that the roadless area be managed for dispersed recreation and studied for wilderness status.

The BLM's proposed Thompson Creek Natural Environment Area is adjacent to the lease site on the east. It may also be studied as a roadless area for wilderness status (see map A2-3).

Recreational facilities are located in nearby Glenwood Springs and Carbondale. The world's largest hot spring pool is located in Glenwood Springs. The city also has a swimming pool, ten tennis courts, two nine-hole golf courses, and a softball program. Carbondale recently established a recreation commission, which provides programs in basketball, softball, volleyball, and soccer. The commission also operates tennis and basketball courts, a playground park, and softball diamond. Glenwood Springs and Carbondale provided no recreational use information; however, summer use of facilities has been observed to be high.

Visual Resources

The landform in the vicinity of the Anschutz Thompson Creek mine site is characterized by steep hills and valleys. The slopes around the site are intermittently steep or moderately sloping as they ascend from Thompson Creek to the adjacent land heights, such as Stony Ridge. Some rock cliffs occasionally outcrop along the northern slope, but they are mostly not visible.

Conifers grow on the darker, north-facing slopes, and aspens on the higher, flatter ground, while mountain shrubs are intermixed on all the slopes. The warmer, south-facing slopes support a sparse pinyon-juniper cover.

Occasional vistas of Mt. Sopris and the limited human modification of the landscape help support the overall primitive character of the Thompson Creek area. The dirt access road to the site crosses Jerome Park, a wide valley, which has some agricultural development. The existing Anschutz mines are located in a low spot, which restricts viewing to a small visual area, but they are a major landscape modification along the North Thompson Creek drainage.

The proposed site expansion and the present facilities are located in a temporary VRM Class V (see appendix F for VRM class descriptions) which indicates the need of reclamation prior to the landscape's achieving its Class III potential. Figure A2-6 shows the proposed site area.

Socioeconomic Conditions

Demography

The Anschutz mine site is located within Pitkin County, but the only access to the site is through Garfield County and the town of Car bondale, which is approximately 12 miles by gravel road from the mine site. Other communities within the vicinity of the mine site include Glenwood Springs, New Castle, Silt, and Rifle in Garfield County; Basalt in Eagle County; and Aspen in Pitkin County.

Population information on all of these communities is included in table A2-9. The table indicates that the area in and around Carbondale has experienced very rapid growth in the last seven years, much of it as a result of new coal mining in the Coal Basin area of Pitkin County. The growth in recreation, especially skiing in the Aspen area, has also contributed significantly to growth in Carbondale. All other communities in the area have experienced some population growth since 1970. Aspen, Basalt, and Silt have all grown rapidly, primarily because of recreation in Aspen and Basalt and highway construction in Silt.

The declining median age of the population indicates an in-migration of primarily young persons to the area, which is common for recreation-oriented areas. Only New Castle and Rifle have significant concentrations of elderly people.

Community Attitudes and Lifestyle

Communities in the Roaring Fork River Valley (Aspen, Basalt, Carbondale, and Glenwood Springs) have evolved from dependence on a mining and ranching economy to dependence primarily on the recreation industry. In the transition, many younger, well-educated people have migrat-

TABLE A2-7

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 43

	Deer	Elk	Bear	Mountain Lion	Totals
Hunters	1,237	1,904	127	-	a/
Recreation days b/	4,878	8,508	866	-	14,252

Source: Colorado Division of Wildlife, 1976 Big Game Harvest.

a/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

b/ All or part of a day.

TABLE A2 -8

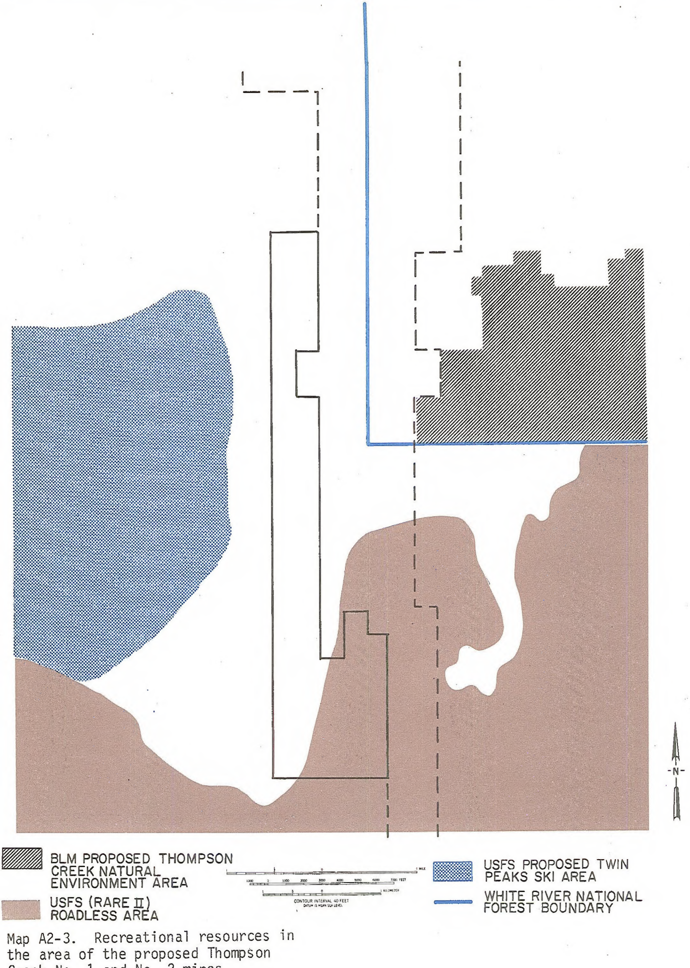
SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 54

Animal	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	475	2,078	Badgers	10	289
Geese	29	142	Beavers	17	394
Doves & pigeons	132	433	Bobcats	12	619
Turkeys	38	0	Coyotes	25	732
Grouse	1,516	4,971	Foxes	5	314
Ptarmigans	171	303	Martens	2	68
Rabbits	1,295	6,333	Minks	2	14
Squirrels	169	468	Muskrats	14	377
Coyotes	269	1,576	Raccoons	12	388
Marmots	367	1,095	Skunks	7	206
Porcupines	160	278	Weasels	2	2
Raccoons	29	119			
Prairie dogs	29	168			
Magpies	176	474			
Crows	37	73			
Total	b/	18,511		b/	3,403

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals not provided as hunting and trapping or more than one species is allowed.



Map A2-3. Recreational resources in the area of the proposed Thompson Creek No. 1 and No. 2 mines

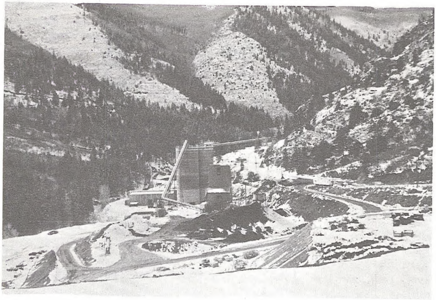


Figure A2-6. The existing Anschutz mine is located in the North Thompson Creek valley, where it dominates a restricted landscape.

ed into the area from all parts of the country, to take advantage of the recreational opportunities. Residents emphasize preserving the environmental quality of the area, both the recreational value and the quality of life for its inhabitants.

Community Facilities

Many of the towns and cities in Garfield county have either recently expanded the capacity of water and sewage treatment systems or plan to in the near future. (The towns and capacity of the improved systems are shown in table A2-10.) The county and towns cooperate to provide sanitary landfills; only Glenwood Springs provides pickup service. Most of the areas are served by volunteer fire departments. Rifle needs to expand or replace its fire station, police headquarters, library, and city hall. Carbondale needs a new city hall (see figure A2-7). Revenue figures show that Garfield County would be able to provide the necessary facilities.

Housing

The Colorado Division of Housing estimated that total housing stock increased by 29 percent in Garfield County and 105 percent in Pitkin County between 1970 and 1976. In Garfield County, the housing stock increased at a rate similar to the population increase. Mobile homes in Garfield County increased from 13 percent of the total housing stock to 19 percent.

In Pitkin County, the housing stock increased much more rapidly than the total permanent population, indicating the addition of many second homes and condominium units to serve the resort community. Mobile homes in Pitkin County decreased as a percentage of the total housing stock between 1970 and 1976, making Pitkin the only county in the ES area where that was the case.

Available housing in the Roaring Fork Valley is very limited. Housing prices, both for rental and sale housing, are significantly higher in this area than in other parts of the ES area because of its proximity to the major resort town of Aspen.

Education

The Roaring Fork RE-1(J) and the Garfield RE-2 school districts serve the area of Garfield County within the vicinity of the Anschutz site. The Roaring Fork district also includes that portion of Pitkin County where the Anschutz lease is located.

The Roaring Fork School District had 3,206 students in school year 1975-76 and a pupil teacher ratio of 21 to 1. The district operated four elementary schools, three junior high schools, and three high schools and was operating at 80 percent of design capacity.

The Garfield School District had 1,549 students in 1975-76 and a pupil teacher ratio of 18 to 1. The district operates three elementary schools, two junior high schools, and one high school and is at 90 percent of capacity. More detailed information is available in the regional volume, as is a map of the district boundaries.

Health Care

Primary health care for the area is provided by the Aspen Valley Hospital in Aspen and the Valley View Hospital in Glenwood Springs. Both hospitals are presently operating at about 80 percent of capacity. The Clagett Memorial Hospital in Rifle serves the central and western portions of Garfield County. It is presently operating at only 40 percent of capacity. Ambulance service is available from all of the other smaller communities in the area to one of these three hospitals.

Both Glenwood Springs and Aspen have an abnormally high number of physicians for their population sizes. Additional information on health care services in this area can be found in the regional volume, chapter 2, Socioeconomic Conditions.

Employment

The two most important sectors in Pitkin County are services and trade, reflecting the importance of the recreation industry there. Most of the Anschutz employees live in Garfield County, where trade, services, and government are also important. More detailed information about employment in these counties is available in the regional volume. Employment data for individual towns and cities are not available.

Income

Pitkin County, where the Anschutz mine is located, has the highest income levels in the seven-county ES area. In 1974, per capita income was $7,896, well above the state average of $5,514 and the national average of $5,449. Over half of the personal income in the county is generated by two sectors: (1) wholesale and retail trade at 24.9 percent and (2) services at 33.8 percent. This indicates the importance of the tourist and ski industries in the county. Other sectors and the proportion of income produced are contract construction, 13.8 percent; finance, insurance, and real estate, 11.3 percent; government, 8.8 percent; transportation, communication, and public utilities, 4.7 percent; manufacturing, 1.9 percent; agriculture, 0.4 percent; mining, 0.4 percent; and other industries, 0.3 percent.

The road to the Anschutz mine comes from Carbondale in Garfield County. Garfield County has the second highest income level in the ES area, with a 1974 per capita income of $5,106. However, per capita income in Carbondale in 1974 was only $4,049. Average income of Anschutz' mine employees is estimated by the company at $16,600 per

TABLE A2-9

POPULATION STATISTICS

Community	Total Population 1970	Total Population 1977	Percent Change 1970-1977	Median Age 1970	Median Age 1977	Percent of Population Over 65 Years 1977
Garfield County:	14,821	18,800	27	30.0	28.4	10
Carbondale	726	1,644	126	-	25.6	5
Glenwood Springs	4,106	4,091	-	35.0	31.0	14
Glenwood Springs Area	8,729	11,109	27	28.3	27.5	8
New Castle	499	543	9	-	30.5	18
Silt	434	859	98	-	28.8	11
New Castle Area	1,976	3,278	66	34.3	28.4	10
Rifle	2,150	2,244	4	33.5	34.1	17
Rifle Area	3,297	3,555	8	32.7	32.0	14
Eagle County:	7,498	10,257*	37	-	-	-
Basalt	419	518*	24	-	-	-
Pitkin County:	6,185	8,765*	42	27.0	-	-
Aspen	2,437	3,346	37	26.4	-	-

Source: U.S. Bureau of the Census, 1970 Population Census, 1977 Special Population Census.

* 1975 figure.

TABLE A2-10

GARFIELD COUNTY: POPULATION CAPACITY OF IMPROVED WATER AND SEWAGE TREATMENT SYSTEMS

Town or City	Water	Sewer
Rifle	5,000	10,000
Silt	1,600	1,600
Glenwood Springs	10,000	14,500
Carbondale	8,000	6,000
Grand Valley	160 taps	130 taps
New Castle	Plans to expand present systems	

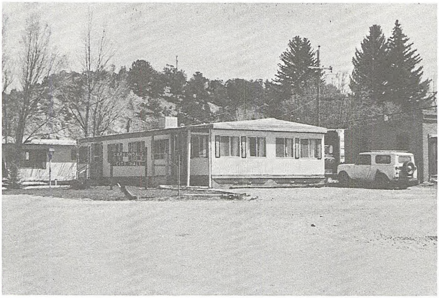


Figure A2-7. Carbondale city hall.

year. (The regional volume contains further information about income in the area.)

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describe the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceding sections of chapter 2 which are expected to change in the future: air quality, mineral resources, water resources, vegetation, wildlife, aquatic biology, archeological resources, livestock, recreation, visual resources, and socioeconomic conditions. Anschutz owns enough private coal reserves to continue the proposed operation without federal approval.

Air Quality

The mines would increase annual average particulate concentrations by 40 micrograms per cubic meter ($\mu g/m^3$) in only a very small area on the mine site northeast of the preparation plant and parallel to a short section of haul road. Concentrations are predicted to increase by at least 20 $\mu g/m^3$ on both sides of the haul road. Concentrations of 10 $\mu g/m^3$ are predicted at distances of 0.7 to 1.5 miles from the haul road.

The highest 24-hour concentrations of 159 $\mu g/m^3$ and 132 $\mu g/m^3$ are predicted to occur northeast of the preparation plant and near the haul road. Maximum concentrations will decrease rapidly with distance from the haul road. At 1 mile on either side of the road, predicted maximum concentrations are in the range of 30 to 40 $\mu g/m^3$.

The estimated reduction in visual range to the north as a result of mining emissions would be about 18 miles on an annual basis. However, along any other line of site (east, west, or south) concentrations would be increased an average of about 8 $\mu g/m^3$ over the same distance and therefore visibility would be reduced by about 9 miles.

Mineral Resources

Without the proposed action, Anschutz would mine 15.5 million tons of coal from its 5,326 acres of private coal.

Water Resources

Additional consumption of both surface and ground water would occur. The consumption of surface water would cause an increase in mineral concentrations by decreasing the dilution factor of this chemically marginal aquatic habitat. There would also be increased pressure on the municipal water supply systems in the area due to population increases associated with these mines.

Vegetation

Anschutz' proposed rail loadout facility at Carbondale would disturb 40 acres of irrigated and nonirrigated pasture.

Urban expansion caused by population increases related to coal mining would result in the disturbance of an estimated 68 acres of vegetation by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers.

Increased numbers of people in the area would result in additional disturbance of native vegetation, particularly by off-road vehicle use. This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Wildlife

The Anschutz mines are already in operation and could continue operating through 1990 even without the federal lease. As a result, wildlife habitat would be lost because of refuse piles, settling ponds, and additional road development; the quantity and quality of habitat available to aquatic species would be reduced by reduction of downstream flows; and road kills could increase because of the increase in coal truck traffic and miners' vehicles. In addition, increased human populations would cause urban expansion onto agricultural lands and some winter range, as well as an increase in legal and illegal harvest of wildlife. Increased recreational activity would cause additional stress to animals and some loss of animals.

Aquatic Biology

During low flow months North Thompson Creek would be vulnerable to loss of fisheries due to changes in water quality. If the discharge of mine water continues as it was occurring at the time of the study then the stream would be degraded by increased total dissolved solids, sulfate, and iron. Occasional increases in turbidity in the stream from old coal spoils piles and from surface runoff from facilities and mine road would decrease the productivity of aquatic insects and trout species in the stream.

At full production mine water discharge would cease. At this time diversion of 0.25 cfs may partially dewater the stream in late summer and cause a proportional loss of the fishery. A refuse water storage reservoir has been proposed, and if it is built it would eliminate direct discharge of mine water to the stream. This would help to return the aquatic habitat to a more normal condition. The potential for extensive degradation of North

Thompson Creek from retention structure failure would exist as long as the facilities remain on the site.

Archeological Resources

Through the year 1990, vandalism and weathering would be the two major factors causing the loss of archeological values. It is doubtful that additional monies or employees would be available to retard this loss, although the Federal Land Policy and Management Act of 1976 will provide BLM with more protective enforcement authority. The decrease in archeological resources is expected to continue or accelerate under the present land use management program.

Livestock

The disturbance of agricultural land by the rail loadout facilities at Carbondale (40 acres of disturbance) may adversely affect the livestock industry in the area because the area to be disturbed is irrigated and nonirrigated hayland and pasture. These lands are used as livestock wintering areas and the hay harvested from them in the summer is used to feed livestock during winter. The loss of them may result in hardship on some livestock operators.

The above discussion is also true for the acreage disturbance resulting from urban expansion due to population increase from the proposed action: 60 acres in 1980, 62 acres in 1985, and 68 acres in 1990. It is probable that much of this disturbance would be on irrigated and nonirrigated hayland and pasture.

Recreation

The final designations given to the U.S. Forest Service RARE II roadless area and the BLM wildland study area will affect recreation on these sites. Should wilderness designations be given, travel and recreation would be restricted to nonmotorized forms.

Growth in Garfield County would increase by 26,450 people from 1977 to 1990, which would require 87 additional acres of community active/improved parkland (e.g., ballfields, playgrounds, tennis courts) to prevent overuse and deterioration of existing facilities (Bickert, Browne, Coddington, and Associates, Inc., 1977).

Visual Resources

Any future changes in visual status of the North Thompson Creek area would result from USFS and BLM management actions and private development. The continued operation of the existing mine for private coal development would result in continued landscape modification for refuse, storage, etc., and truck use of the Jerome Park road. Residential expansion on the private lands is possible, based on projected population increases in Garfield and Pitkin counties and the lure of the natural amenities of the area. The North Thompson Creek area would retain a modified natural appearance but with increased cultural modifications.

Socioeconomic Conditions

Garfield County is projected to grow at a rapid rate to 45,238 people in 1990 primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale development.

Mining of Anschutz-held private coal would cause Garfield County population to increase by 800 in 1990 (or less than 0.02 percent of total projected growth). Development associated with Anschutz by 1990 would require a total of 267 housing units in the county, would increase school enrollment by 200 students (primarily in the Roaring Fork School District), and would increase employment in the county by 653 people. No other new mining development is proposed for this area at the present time.

Recreation-related development is expected to continue to exert population growth pressures on Carbondale, Basalt, and Aspen.

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), and it does not fully reflect the requirements of the initial regulations. However, in this environmental statement (ES) the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial regulations. The Department of the Interior will not approve the M&R plan until Anschutz Coal Corporation has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Thompson Creek mines include conveyors, transfer points, haul and access roads, and wind erosion of refuse piles. Some common sources of fugitive dust at underground mines are not projected for the Thompson Creek mines: crushing and sizing should produce negligible emissions because a wet process would be used; raw and clean coal would be stored in silos rather than in open storage piles.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution- producing operation, (2) multiply that activity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Thompson Creek mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division and a recent study of emissions from mining (Colorado APCD 1978, Axetell 1978).

Table A3-A presents estimates of fugitive dust emissions at the Thompson Creek site from each of the identified sources in 1980, 1985, 1990, and 2008 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The estimates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table A3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Thompson Creek site other than fugitive dust sources were exhaust emissions from diesel-powered haul trucks and employees' motor vehicles on mine access roads. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table A3-B. These emissions are based upon rates per mile of travel (emission factors) which would decrease between 1980 and subsequent study years. In the case of Thompson Creek, the reduced emission rates result in substantially lower total emissions in later years of the mine's operation. These emissions are

from both employee travel and haul trucks on the road to Carbondale.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site, especially since they are distributed uniformly over the 12 mile length of the road.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the valleys near where mining emissions occur. The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes. Predicted concentrations are usually accurate within a factor of three.

Since there are no wind data available for the North Thompson Creek area (see chapter 2), the wind and stability data required for the model were obtained by modifying that from Grand Junction airport to reflect the up valley-down valley or east-west orientation at this site. This wind rose was previously shown in figure A2-A. Emission data were presented in table A3-A.

Predicted increases in ambient concentrations resulting from Anschutz' operation in 1980, 1985, and 1990 are shown on map A3-A. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 40 micrograms per cubic meter ($\mu g/m^3$) in only a very small area on the mine site northeast of the preparation plant and parallel to a short section of haul road. Concentrations are predicted to increase by at least 20 $\mu g/m^3$ on both sides of the haul road. Impact on air quality decreases rapidly with distance from the haul road. Concentrations of 10 $\mu g/m^3$ are predicted at distances of 0.7 to 1.5 miles from the haul road.

The Thompson Creek mines presently produce 20,000 tons of coal annually and the proposed action would increase annual production to 1.0 million tons per year by 1980. Therefore, the total impact at full production (shown on map A3-A) and the incremental impact from the proposed action would be nearly the same.

The predicted impact of the mines is less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. In a very limited area, it does exceed the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD). However, coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

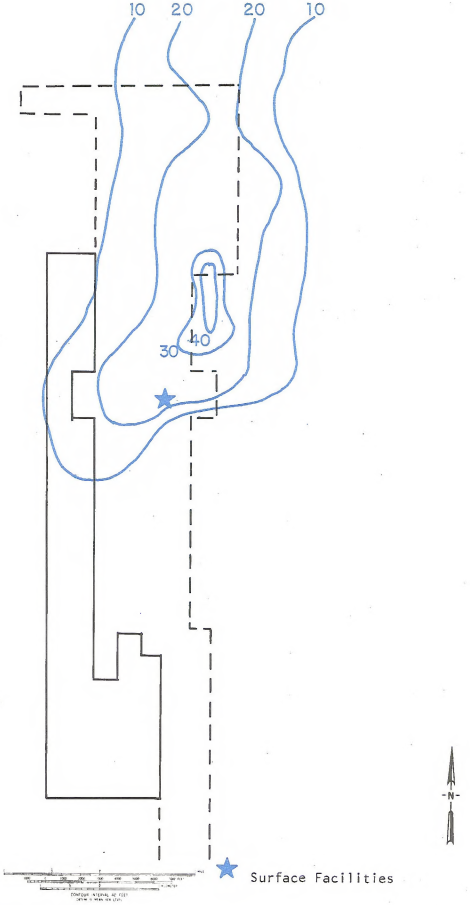
The dispersion model used to predict maximum 24-hour particulate concentrations was a subroutine of the CDM model which employs a statistical prediction method to relate average and maximum air pollutant concentrations. Because of this procedure, the predicted maximum 24-hour concentrations at different locations on and near the mine site fall in the same relative order as the predicted annual average concentrations. The highest 24-hour concentrations of 159 $\mu g/m^3$ and 132 $\mu g/m^3$ are predicted to occur northeast of the preparation plant and near the haul road (at the location of the 40 $\mu g/m^3$ isopleth on map A3-A). Maximum concentrations decrease rapidly with distance from the haul road. At 1 mile on either side of the road, predicted maximum concentrations are in the range of 30 to 40 $\mu g/m^3$

These concentrations are less than the 24-hour primary air quality standard of 260 $\mu g/m^3$, but in one case exceed the secondary standard of 150 $\mu g/m^3$. However, the area with the very high short-term concentrations is quite small.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine would reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west-central Colorado has been empirically determined by Ettinger and Royer (1972) as shown in figure A3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due



Map A3-A. Predicted increases in ambient concentrations in 1980, 1985, and 1990 (micrograms per cubic meter)

TABLE A3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED THOMPSON CREEK MINE SITE

Emission source	Emissions, ton/yr		
	1980	1985	1990 & EML
Conveyor - 7 sections	96.2	96.2	96.2
Transfer points - 5 points	206.2	206.2	206.2
Preparation plant - wet process	neg	neg	neg
Truck loadout	0.1	0.1	0.1
Open storage - raw coal	neg	neg	neg
- clean coal	neg	neg	neg
Haul roads - coal	2402.6	2402.6	2402.6
- refuse	5.6	5.6	5.6
Access roads	906.2	906.2	906.2
Exposed areas - refuse	1.9	1.9	1.9
- rail (off site)	12.2	12.2	12.2
TOTAL	3631.0	3631.0	3631.0

TABLE A3-B

EMISSIONS OF GASEOUS POLLUTANTS FROM THE PROPOSED THOMPSON CREEK MINE SITE

Year	Total emissions from vehicles, ton/yr			
	CO	HC	NO_x	SO_x
1980	92.0	8.3	14.3	2.8
1985	55.3	5.3	14.8	2.8
1990	32.1	3.4	8.7	2.8

$L_v = \frac{24}{0.2 + 0.007\ M}$, where

L_v = Average visual range, miles

M = Average particulate concentration (micrograms per cubic meter)

Figure A3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).

to precipitation. Therefore, the equation is more likely to predict visual range over an averaging period of a year than for a short-term period such as 24 hours.

As indicated on map A3-A, particulate concentrations in each study year would be increased to a distance of at least 4 miles north of the surface facilities. Along a line of sight to the north, concentrations would be increased an average of about 20 $\mu g/m^3$ over this distance. Using the equation above and a background particulate concentration of 24 $\mu g/m^3$, the estimated reduction in visual range on the mine site as a result of mining emissions would be about 18 miles on an annual basis. However, along any other line of sight (east, west, or south) concentrations would be increased an average of about 8 $\mu g/m^3$ over the same distance and therefore visibility reduction would be about 9 miles.

Geologic and Geographic Setting

Topography

Topographic impacts to the North Thompson Creek mine property from the proposed action would be minimal. Surface facilities supporting the operation are either completed or currently under construction. Therefore, the only sources of further topographic impacts would be long-term use of the refuse disposal area and surface subsidence.

Long-term use of the phase I refuse disposal area would produce a small area of steepened slopes approaching 33 degrees along the downhill section of the area and a larger area of gentle backslopes. The refuse area occupies 10 acres or 0.25 percent of the North Thompson Creek mine property.

The maximum predictable surface subsidence of the mine property would occur over the easternmost longwall panels. The subsidence in this area would be approximately 3.5 feet at the most. As the overburden increases to the west, the amount of predictable surface subsidence would decrease. Because of the depth of overburden covering most of the mine property which would be mined, the likelihood of open fractures, broken surfaces, and hummocky terrain is slight. The possibility of further subsidence due to spontaneous combustion of the coal seam is also reduced. (See Mineral Resources and Soils for further discussion.)

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased vandalism and unauthorized fossil collecting as a result of increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above disturbance, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the Bureau of Land Management (BLM)-U.S. Geological Survey (USGS) memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

The proposed mining of an estimated 33 million tons of coal over a 50-year period by the Anschutz operation would deplete a nonrenewable mineral commodity. The metallurgical grade coal is expected to be exported from the area to western markets.

Subsidence resulting from the development of the A seam, through the Thompson Creek No. 1 Mine, would have no effect on the Anderson seam, developed through the Thompson Creek No. 3 Mine, because of the 800-foot stratigraphic distance between the two seams. Subsidence after mining of the Anderson seam would have little effect on the Sunshine seam because the Sunshine seam lies 60 feet below the Anderson.

The longwall method of mining would result in the recovery of approximately 80 percent of the Anderson and A seams, with an overall recovery of approximately 50 percent of the total reserves. The longwall mining method is the most efficient method to recover the leased coal.

Water Resources

Surface Water

Approximately 30 percent of the water required by the mining operation at full production would be taken from North Thompson Creek. The remaining requirement would be fulfilled by ground water obtained from the mine shaft. As much as 0.20 cubic foot per second (cfs) may be required from North Thompson Creek during periods of low ground water supply. The state of Colorado

has already decreed Anschutz 0.2684 cfs from North Thompson Creek (applications W-2979 and W-2980, March 28, 1977). This water consumption from the stream could impact mineral concentrations by decreasing the dilution factor of the stream. See Aquatic Biology for potential impacts of this dewatering on aquatic life and riparian habitat.

Increased population in Garfield County due to Anschutz would cause an increased consumption of domestic water supply. Based on population projections generated in the socioeconomic section, the estimated increase in domestic water supply for Garfield County (Carbondale and Glenwood Springs) would be 275 acre-feet per year in 1980, 284 acre-feet per year in 1985, and 314 acre-feet per year in 1990. It must be noted that some of this water would come from ground water (wells). However, the number of people who would elect to live in the county where municipal water is not available cannot be determined.

Ground Water

Although Anschutz does not currently own water rights for ground water found within the mines, the company is utilizing the ground water within its mine before resorting to its rights from North Thompson Creek. The impacts of either consuming this ground water or pumping it out into evaporation ponds, allowed for by law, are the same. In both cases, 120 acre-feet of ground water from recharge is being removed annually from the system. It is felt that this loss is insignificant with respect to the water yield of the Crystal River subbasin and would not directly affect any other known water user.

Water Quality

The development of the Anschutz coal mine could degrade the water quality of North Thompson Creek. Drainage within the mining site has been underdesigned and does not comply with 30(CFR): 717.17, which established the 10-year/24-hour frequency storm as the minimum storm size to be used in the design of drainage systems. Compliance with the 30(CFR) regulation as described in Authorizing Actions, chapter 1, would remedy this deficiency.

The mineral and nutrient concentrations of North Thompson Creek, and ultimately of Thompson Creek and the Crystal River, may increase due to a decrease in the dilution factor of the stream. Very low stream flows of less than 1 cfs occur one out of every two years. The mine's daily water requirements from North Thompson Creek during periods of low water supply (August to March) may be as high as 0.20 cfs, or approximately 20 percent of low flow rates.

The construction of a runoff control system and sediment retention ponds would help to improve the general water quality of North Thompson Creek. This action would mitigate many of the adverse impacts of the old North Thompson mine workings.

At best, it is difficult to estimate impacts or changes in the quality of ground water. A potential exists to increase the salt concentrations of the shallow ground water system through the percolation of impounded water through the soil profile. At the same time, however, saline ground water would be consumed by the mining operation and removed from the ground water system. The overall long-term impact is considered to be insignificant, considering the existing impacts of the vast Mancos shale area within this subbasin.

Flood Hazard and Impacts

The existing measures designed to protect the mining area from erosion and from undercutting of the mining facilities are inadequate and threaten the safety of human life and property. Rip-rap of a minimum size of 6 inches is not adequate to withstand flow velocities of 20 cfs, let alone the nearly 4,000 cfs which would result from the flood waters of a 100-year frequency storm. Added debris from the mining site during such a flooding event could cause increased damage downstream around the municipality of Carbondale. However, compliance with 30(CFR): 717 would eliminate this problem.

Soils

Soil impacts would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban area expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 3.5 feet (see Topography). Soil impacts would be minimal where no breaks occur in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

Soil disturbance due to construction and operation of surface facilities would be confined to approximately 86 acres. Included are 46 acres at the mine site, all previously disturbed by the Thompson Creek Coal and Coke Corporation and an additional 40 acres of irrigated and dryland pasture at Carbondale for rail loadout facilities. Specific plans for the loadout are not available. At the mine site, however, accelerated erosion is now occurring and would continue until mechanical stabilization or revegetation is accomplished. Within the design limitations of the proposed action, most of this erosion would be contained on-site by drainage systems and other sediment control measures. However,

these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology). Over the 50-year mine-life, there is a 99 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration of soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable at present, would further complicate inherent revegetation problems of low natural moisture, poor topsoil, and often steep terrain. These problems would prolong the efforts necessary to achieve successful reclamation (see Vegetation).

Off-site disturbances due to mine-related population increases would amount to 60 acres by 1980, 62 acres by 1985, and 68 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come from croplands around Carbondale. To this extent, crop production capacity would be permanently lost. Soil erosion could initially increase from two to seven times the natural rate, then gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

Anschutz plans to use the mine portals and surface facilities constructed by the Thompson Creek Coal and Coke Company, and no additional surface disturbance would occur, with the exception of a rail loadout facility at Carbondale. This facility would disturb 40 acres of irrigated and nonirrigated pasture (see Livestock).

Anschutz would be required to revegetate the 46 acres of existing disturbance at the Thompson Creek site upon abandonment of the mines. Specific revegetation measures that would be required by the federal coal mining regulations are stated in 30(CFR): 717.20, and 30(CFR): 211.40, 211.41, and 211.62, in the *Federal Register* (vol. 42, no. 239 and vol. 41, no. 96). These regulations cover Anschutz' responsibility and length of liability for revegetation. They state that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vegetation, shall be established on regraded and other affected lands' (30(CFR): 211.40(a)(13)(i)). It is expected that the successful revegetation of the disturbed areas could occur within the five-year minimum timeframe as stated in 30(CFR): 211.40(a)(13)(ii), since the Thompson Creek mine site has a relatively high annual precipitation amount. Problems which may hinder revegetation efforts and which could delay successful revegetation at the Thompson Creek mine are the replacement of topsoil at too shallow a depth and weed infestation.

Urban expansion caused by population increases related to coal mining would result in the disturbance of an estimated 60 acres of vegetation by 1980, 62 acres by 1985, and 68 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers. This is discussed further under Soils and Livestock.

Increased population in the area would result in additional disturbance of native vegetation, particularly by off-road vehicle (ORV) use (see Recreation). This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Wildlife

Waste disposal areas would cause a loss of terrestrial habitat during the period they are in use and for several years following rehabilitation. Currently 46 acres of habitat have been disturbed, and no further disturbances are projected through 1990. This 46 acres would be lost for the life of the mine. It would normally support a winter population of 6 deer per year (based on 18.5 deer days of use per acre), and 18 elk per year. (See table A3-1 for the total number of deer and elk the area would support.) Increased human and mechanical activity would also reduce mule deer and elk use by an average of 50 percent on an adjacent 240 acres (assuming that impacts would be progressively less, the farther the habitat is from the disturbance). In addition, the small mammal, reptile, and amphibian populations would be lost during the clearing or filling of each site.

If additional road development is needed for surface facilities, such as air vents or power lines, it could intrude on elk calving or wintering areas or on crucial mule deer winter range, disrupting reproduction and causing animals to expend additional energy during the winter. As a result, the area would support fewer animals.

It is difficult to predict to what extent the 3.5 feet of subsidence (worst case) would affect wildlife because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Wildlife would gradually develop trails through the areas.

The railroad loadout in Carbondale on agricultural lands would impact an additional 40 acres. This would affect primarily the small game and those nongame species associated with rural and

TABLE A3-1

EFFECTS ON WILDLIFE

Year	Total Disturbed Acres	Number of Animals that These Acres Could Support					Additional Acres Disturbed	Additional Animals that Could be Supported		
		DDA	D	EDA	E	WH		D 50%	E 50%	WH 50%
1977	46	18.5	6	23	18	-	240	14	47	-
1980	86	18.5	6	23	18	-	240	14	47	-
1985	86	18.5	6	23	18	-	240	14	47	-
1990	86	18.5	6	23	18	-	240	14	47	-

Note: DDA = deer days per acre; EDA = elk days per acre; D = deer; E = elk; WH = wild horses.

agricultural settings, such as song birds, skunks, pheasant, and mourning dove.

The remaining impacts are ongoing with or without development of the federal coal lease. There will continue to be disturbance of deer on winter range due to vehicle traffic through the area (260 vehicles per day plus 286 coal truck trips per day). The possibility of deer/vehicle collisions will increase in proportion to the increases in vehicle traffic (see regional chapter 4).

Aquatic mammals and species associated with riparian habitats could be impacted by the proposed action. Reduction of downstream flows (see Water Resources) would reduce the quantity and quality of habitat available to aquatic species, causing relocation of the animals and birds and subsequent death of these animals if suitable habitats are not available or are overcrowded already.

Secondary impacts from the proposed action would include increased human population, resulting in expansion of urban areas onto agricultural lands and some crucial winter range; increased vehicular traffic, resulting in an increase in vehicle/animal collisions; and increased recreational use of the area, causing an additional stress on the animals and increasing legal and illegal harvest of animals. This illegal kill would increase ten times or 1,000 percent over current estimates (Al Whitaker 1978, personal communication).

Endangered or Threatened Species

No threatened or endangered wildlife species would be impacted by the proposed action.

Aquatic Biology

During most of the year there is sufficient water in North Thompson Creek to dilute legal discharges enough that they will not drastically change the aquatic habitat; however, during the extreme low flow months of September and October, the stream normally flows between 0.09 and 2.00 cfs, making it vulnerable to changes in water quality.

The potential exists for the aquatic life in the stream to be impacted in several ways, especially during low flow months when stream flow has been as low as 0.09 cfs (1967). If the mine water discharge is 86,000 gallons per day, this would equal approximately 0.13 cfs, which would exceed the stream flow at that time. Mine discharge water varies in quality but examples exist where total dissolved solids (TDS) of 1,344 milligrams per liter (mg/l), sulfate of 320 mg/l, and iron of 2.4 mg/l were present in the discharge water. This type of discharge during a low flow period would degrade the aquatic community even though it is legally within 30(CFR): 717.17 standards. Ninety-five percent of all inland waters which support a good fish fauna have TDS below 400 mg/l (Aron 1963), sulfate below 90 mg/l (Aron 1963), and iron not greater than 7.0 mg/l (Hart et al. 1945). The settling pond overflow, outfall 003, may legally discharge 7.0 mg/l total iron. Any discharge with this concentration of iron to the stream during low flow would degrade the stream.

Runoff from snowmelt causes extreme turbidity in North Thompson Creek below the mine site. This is a combination of natural turbidity, turbidity from old coal spoils piles, and surface runoff from mine roads and facilities that is not captured in the site drainage system. Although the site drainage system functions as it was designed, it does not comply with 30(CFR): 717.17, and some sediment continues to enter the stream from disturbed areas. The quality of the aquatic habitat will be lowered by this sediment until Anschutz complies with the regulations. Larger runoff events would compound this problem.

The impact on the stream may change by the time the mines reach full production. All of the ground water from the mines may be used in the domestic water system and for industrial use. The majority of this water would end up in the settling or sewage treatment ponds. Any volume of discharge from these ponds approaching the low stream flow, even if it is in compliance with 30(CFR): 717 and the NPDES permit, would degrade the stream in low flow months. If a greater volume of water is needed in the mine operation than is available from mine ground water and if the 0.25 cfs water right from North Thompson Creek is utilized, partial or total dewatering could occur in low flow months. A major loss of aquatic habitat is possible in this case.

The construction of the proposed refuse water storage reservoir and irrigation system would mitigate stream impacts from discharges. In this case, all waste water from the mine site would be piped to a 45- acre-foot storage reservoir on the Anschutz property, and there would be zero discharge to the stream. The turbidity problem previously described would continue until Anschutz complies with 30(CFR): 717.17.

There are three sewage treatment ponds, two large settling and evaporation ponds, and a detention dam for the refuse disposal site on the mining site. These types of structures have a history of washing out and breaking. Extensive losses and destruction of downstream aquatic resources by sedimentation of the stream bottom and by introduction of substances toxic to insects and trout would result should a structure fail. This could happen either during the period of active mining or when the mine is no longer being worked. Should such a failure occur, the aquatic resources of 7 miles of Thompson Creek and portions of the Crystal River downstream would be lost. Proper con-

struction and operation of facilities in compliance with the regulations in 30(CFR): 717.17 should prevent such failures.

An increase in the human population in the Carbondale area through 1990 (see Socioeconomic Conditions) would increase the development of roads, residential areas, and commercial facilities. As natural watershed areas are converted to these uses, trout streams are invariably reduced in quality due to changes in sediment loads, water quality, and flow regimes. Increased fishing pressure, most notably on the Crystal and Roaring Fork rivers, would increase the reliance on the hatchery raised trout.

Endangered and Threatened Species

No threatened or endangered aquatic species would be affected by the proposed action.

Cultural Resources

Archeology

Surface disturbance from construction and mine activities could result in the destruction or displacement of archeological values. However, the 86 acres proposed (by 1985 and on through 1990) for dirt- moving procedures have already undergone previous surface disturbance. With the natural integrity of the area destroyed, further impacts to archeological values would be minimal.

Although subsidence of the mine property is expected to be slight (3.5 feet at most; see Topography), any alteration of the surface from slumping or breaking could result in the displacement or damage of archeological values.

Increased population in Pitkin County and the upgrading of the roads into the lease area could contribute to an increase in vandalism. With controlled access, however, vandalism within the site-specific area should remain a minimal impact, although the presence of 320 mine- associated workers (by 1980 and on through 1990) would mean increased exposure of existing archeological values to public passage.

Prior to the approval of the proposed action, a concurrence of approval could be developed by BLM and the USFS with the Anchutz Mining Company to provide for the protection of cultural resources. This could include provisions for Class III surveys on private land to undergo surface disturbance and to allow for work stoppage and compliance should archeological values be found after the action has been initiated. In addition, should areas of surface subsidence be identified, provisions for a Class III survey in these impact areas should be established in order to minimize potential damage to archeological sites.

Historical Resources

No additional surface development is planned in the proposed lease area, so no impacts to historical values as a direct result of the proposed action would occur. Nearby historic sites, including the Coke Ovens and a cemetary at Marion Gulch and the Aspen and Western Railroad line from North Thompson Creek, would not be directly affected by mining. However, due to increased traffic and the high visibility of the sites, there could be an increase in visitor use and vandalism associated with such use.

Transportation

Highways

Increased population in the Carbondale area resulting from the Anschutz mines would increase traffic on State Highways 82 and 133. Access to the mines is on a county road with very little public traffic. At full production, employee traffic would reach 260 vehicles per day. Most congestion would be just before and after shift changes. Trucks hauling coal to the rail loading facilities would make 286 trips a day. Since most of this would occur during an eight-hour work shift, it is equivalent to one truck every 1.7 minutes.

Railroads

Shipping of coal on the Denver and Rio Grande Western Railroad would increase congestion on the railroad's facilities. At full production, about two unit trains per week hauling 10,000 tons would be required to move the coal. Congestion would increase in eastern Colorado cities where trains with coal from the Anschutz mine would meet trains from other coal producing areas.

Airlines

Passenger traffic at local airports would increase as a result of growth in the area. However, because of the small size of the airports and the distance from the Anschutz mine, this increase would be minimal.

Livestock

There would be no additional loss of livestock forage at the mine site due to the proposed action, since no additional surface disturbance would occur. The livestock use on the lease area would be enhanced by a proposed project by Anschutz and local ranchers to pump excess mine water into stock reservoirs. The reservoir would improve livestock distribution and forage utilization.

The disturbance of agricultural land by the rail loadout facilities at Carbondale (40 acres of disturbance) may adversely affect the livestock industry in the area because the area to be disturbed is

irrigated and nonirrigated hayland and pasture. These lands are used as livestock wintering areas and the hay harvested from them in the summer is used to feed livestock during winter. The loss of them may cause hardship for some livestock operators.

The above discussion is also true for the acreage disturbed by urban expansion due to population increases from the proposed action (60 acres in 1980, 62 acres in 1985, and 68 acres in 1990). It is probable that much of this disturbance would be on irrigated and nonirrigated hayland and pasture.

Recreation

The influx of additional population due to the Anschutz mines and the subsequently increased demand for recreational opportunities could have an impact on existing recreational resources and facilities. The 1976 Colorado Comprehensive Outdoor Recreation Plan identifies a need for several types of recreational facilities in this state planning region, particularly community type facilities; therefore, increased use would result in overuse of the present facilities. This overuse would lead to their deterioration and lower their capacity to provide enjoyable recreation. The community facilities needed to meet the increased demand and prevent overuse are projected in table A3-2, which shows a need for 2.3 acres of active/improved park land by 1980, 2.4 acres by 1985, and 2.6 acres by 1990. Capital investments to provide these facilities are also projected in table A3-2.

The increased demand for dispersed recreation opportunities (e.g., hunting, hiking, ORV) should not adversely affect the recreation resource; however, concentrated use, such as an ORV rally, could lead to vegetative deterioration and lower the recreational experience on that site. Increased use of recreational facilities (such as USFS camp grounds) would lead to increased maintenance costs for the managing agencies. The extent of increased cost is not known.

The increased use of recreational facilities could be offset by providing additional facilities. The Heritage Conservation Recreation Service, through the Land and Water Conservation Fund Act (PL 88-578), could provide monies for this purpose if matching funds are provided by the local agency. The Mineral Leasing Fund (Colo. SB no. 35, sect. 2, 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreation facilities under the Recreation and Public Purposes Act, 43(CFR): 2740, which allows nonprofit associations to acquire lands for recreation purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior; therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The county road leading to the Anschutz mines is presently used as a sightseeing route and as access to lands beyond the mine site. The aesthetic quality along the roadway would be lowered due to the increased coal-related use (260 vehicle trips by employees and 286 coal truck trips per day by the fifth year). The increased use and associated road deterioration would also increase probability of accidents for recreational users of this route.

The U.S. Forest Service has a RARE II wilderness study area just south of the proposed mining area, and BLM has the proposed Thompson Creek Natural Environment Area adjacent on the east which will also be a wilderness study area. Impacts on these areas from the mining of federal coal should not be significantly increased from the effects of the present level of production.

Visual Resources

The existing VRM Class V for the mining area would be maintained for a longer period of time by approval of the proposed action. There would be two types of visual impacts associated with the expansion of the Anschutz operation, those directly related to landscape changes on the site and those secondary, associated impacts that could affect the perception of adjacent landscapes. The North Thompson Creek site is already characterized by industrial development, with coal silos, portal, surface facilities, parking, etc., so that the proposed increase of coal production and employment at the Anschutz site would be an expansion of the existing activity. The location of the site in the stream bottom restricts visual access to occasional viewers passing by on the county road. This condition would be changed only if the mine refuse sites are dispersed, making them more visible.

The terracing of the three refuse sites would create a parallel, horizontal plane configuration which would be unique for the existing visual composition of the area. Landforms now are steeply sloping and devoid of natural land-slump terraces that create horizontal lines on the surface; therefore, the disposal sites would not blend with the landform, especially with color and vegetation differences. The severity of this contrast could be mitigated by revegetation. (See appendix F for visual contrast rating.)

During the operation phase, coal-hauling trucks would make 286 trips per day between the mines and Carbondale, which would reduce the scenic quality of Jerome Park and lessen its recreational appeal. Road dust and other forms of air pollution would reduce visibility, especially for the 4-mile valley north of the mine site. This haze layer

TABLE A3-2

ANSCHUTZ: ADDITIONAL COMMUNITY RECREATION FACILITIES DEMAND

	1980	1985	1990
Population growth	700	725	800
Active/improved parks a/ (3.3 acres per 1,000)	2.3	2.4	2.6
Capital investment ($66,666 per 1,000)	$46,666	$48,333	$53,333

Source: Bickert, Browne, Coddington, and Associates, Inc., Boomtown Financing Study, Vol. II (July 1976).

a/ Ballfields, tennis courts, playgrounds, etc.

would degrade the visual clarity of the local air. (See Air Quality.)

Socioeconomic Conditions

Demography

The proposed action would cause Anschutz to increase its total employment from the present 140 workers to about 320 employees by 1980. It is anticipated that almost all of these new employees would reside in Garfield County, in either Carbondale or Glenwood Springs. These new employees would generate a total population growth in Garfield County of 700 persons by 1980, 725 persons by 1985, and 800 persons by 1990. This population, directly attributable to Anschutz, would account for only about 4.5 percent of the total projected population growth in Garfield County by 1980. It would, though, be a most significant contributor to population growth in the southern part of the county, particularly in the Carbondale area.

Community Attitudes and Lifestyles

Coal mining has been a way of life in the Carbondale area for a long time. More recently, the area has been influenced by increased tourism and the expanding recreation industry in nearby Aspen. These two industries, although different in orientation, have co-existed well in the past. It is expected that coal mining and recreation can remain compatible, even as both continue to expand.

Community Facilities and Services

The community facility requirements associated with the development of the Anschutz mines are listed in table A3-3. These figures were derived in a similar manner to those contained in the regional volume in table R4-19. These figures do not take into consideration the substantial increase in water and sewer utility capacity which has recently been added in Carbondale. Providing that much of the new population associated with Anschutz resides in Carbondale, there would be adequate water and sewer facilities in place to provide for their needs. It should be kept in mind that the community is relying on increased revenues from that population growth to pay for the new facilities.

Pitkin County would receive considerable property tax revenue from this mine. Of the facilities only the train loadout is located in Garfield County. Property taxes on the mine facility would be $377,220 per year. Property taxes on coal mined would be $26,840 in 1980, and $109,540 in 1985 and 1990.

Garfield County would receive increased tax revenues from the loadout facilities and from population growth in the county. County- wide revenues from property taxes on new homes and businesses, the loadout, sales tax, and water and sewer service fees would be $560,690 in 1980, $573,720 in 1985, and $612,710 in 1990. Table A3-4 shows how these revenues would be distributed among the various recipients in the county. Even though the Anschutz mines are located in Pitkin County they is within the boundaries of the Roaring Fork School District, which would receive $285,510 in 1980, $343,940 in 1985, and $343,940 in 1990.

Comparing these revenues with the yearly operating expenses and amortized capital expenses of $122,000 shows that Garfield County, as a whole, would be capable of providing for most of the expected increase in local government costs from locally derived revenues. These figures do not, however, consider the unavoidable lag period which exists between the time that new population arrives and the first ad valorem property revenues are realized.

Housing

The demand for new housing as a result of the population growth in Garfield County attributed to the Anschutz mines is listed in table A3-5. These figures are based on the assumption that average household size would be 3.0 persons and that a constant mix of 65 percent single- family units, 25 percent mobile-home units, and 10 percent multi-family units would be maintained.

The projected new housing requirements associated with Anschutz amounts to 4 percent of the total projected new housing requirements for the county by 1980. About 60 acres of vacant land would be necessary to support the housing and related roadway requirements by 1980, 62 acres by 1985, and 68 acres by 1990.

At the present time, some of the housing in the Carbondale area is occupied by service workers from the Aspen area. An increased demand for housing in Carbondale on the part of coal mine employees would cause the price of housing to rise, displacing these service workers, as well as others on low or fixed incomes.

Education

The expected increase in school-aged population due to the development of the Anschutz mine is shown in table A3-6, along with the increase in school capital requirements and operating costs expected from that population increase.

The Roaring Fork School District RE-1(J), in Garfield County would absorb most of these increased costs. The district, because it includes that portion of Pitkin County where the Anschutz lease is located, would benefit from the $13.3 million in assessed valuation that is expected to be derived from the Anschutz mine installation and the railroad loadout facilities. Combined with an additional $3.5 million projected increase in residential and commercial assessed valuation, the Anschutz devel-

TABLE A3-3

ANSCHUTZ: REQUIREMENTS FOR COMMUNITY FACILITIES IN GARFIELD COUNTY

	Water Treatment	Sewage Treatment	Police Protection	Fire Protection	Streets and Roads	General Government	Libraries	Total Costs
Physical Plant Requirements	0.28 mgd	0.08 mgd	1 vehicle & 320 sq. ft.	800 sq. ft.	24 acres	200 sq. ft. space	440 sq. ft. and 2,400 volumes	
Capital Costs a/	$245,000	$264,000	$29,500	$32,000	$773,000	$12,900	$32,500	$1,389,000
Operating Costs a/								
1980	$ 15,400 per year	$ 11,300 per year	$20,000 per year	-	$ 20,500 per year	$18,000 per year	-	$ 85,200 per year
1985	$ 15,900 per year	$ 11,700 per year	$20,000 per year	-	$ 21,100 per year	$18,000 per year	-	$ 86,700 per year
1990	$ 17,500 per year	$ 12,900 per year	$40,000 per year	-	$ 23,300 per year	$18,000 per year	-	$ 111,700 per year

Note: mgd = million gallons per day; sq. ft. = square feet.
a/ Constant 1978 dollars.

TABLE A3-4

DISTRIBUTION OF ANSCHUTZ REVENUE TO GARFIELD COUNTY

Year	County	Munici-palaties	Special Districts	School Districts
1980	110,860	16,280	7,430	277,500
1985	113,260	16,880	7,590	283,490
1990	120,220	18,620	8,060	300,910

TABLE A3-5

ANSCHUTZ: NEW HOUSING REQUIREMENTS IN GARFIELD COUNTY

Year	Single Family Units	Mobile Homes	Multi-Family Units	Total Units
1980	152	58	23	233
1985	157	61	24	242
1990	173	67	27	267

TABLE A3-6

ANSCHUTZ: SCHOOL REQUIREMENTS IN GARFIELD COUNTY

	1980	1985	1990
Total Increase in Students	180	185	200
Facility Requirements	25,000 sq.ft.	26,000 sq.ft.	28,000 sq.ft.
Facility Costs	$1,125,000	$1,170,000	$1,260,000
Operating and Maintenance Costs	$221,000 per year	$227,500 per year	$246,000 per year

Note: sq.ft. = square feet.

opment would increase the district's bonding capacity by about $3.4 million by 1990. That increase in school bonding capacity is more than adequate to compensate for projected capital requirements.

Health Care

Population growth from the Anschutz mine development is expected to increase the demand for health care services in Garfield County. The nearest hospital and most of the physicians in the vicinity are located in Glenwood Springs, and they will be relied upon to provide for increased demand for health care. The health care services available in Glenwood Springs would also be called upon to provide for oil shale-related population growth in the county. In order to meet the total future requirements for health care services, it would be necessary to expand the facilities in Glenwood Springs, or build additional facilities in the Carbondale area.

Employment

Even though the Anschutz mines are located in Pitkin County, the social and economic impacts are expected to occur in Garfield County, particularly the Carbondale area. By 1980 the mines would be at full employment of 320 persons. These people would generate jobs in other sectors resulting in an increase in total employment in the county of 587 persons by 1980, 626 persons by 1985, and 657 persons by 1990. By 1990 the Anschutz mines would cause an 8.4 percent increase in total employment over the 1977 level.

Income

The average income of mine personnel as outlined in the Anschutz mining plan would be $16,600 annually, as compared with the 1975 median family incomes of $11,565 in Garfield County and $15,643 in Pitkin County. The total payroll of the Anschutz operation, with 320 employees, would be $5,312,000 at peak production. The multiplier effect (explained in the regional volume) would result in a total regional income increase of $8,075,200.

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce or eliminate specific adverse impacts of the Anschutz Coal Corporation's proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the mining and reclamation plan is approved, they would be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

A surfactant will be added to the water spray used on the conveyors and transfer points. This mitigating measure will be required by the Colorado Air Pollution Control Division as a condition of the mines' operating permit.

Anschutz Mitigating Measure 2

The 10-mile section of existing unpaved haul road/access road from the mines to the Pitkin County line will be treated with an appropriate stabilization chemical.

Anschutz Mitigating Measure 3

To prevent undercutting and erosion of portals and facilities, cement retaining walls will be constructed in place of the proposed berms and riprap. The retaining walls will be of sufficient height and thickness to withstand a flood peak of 5,000 cubic feet per second. All construction materials, such as mine props, will be stored a minimum of 50 feet above the elevation of the stream channel.

Anschutz Mitigating Measure 4

Zero discharge from sediment and sewage ponds will be achieved by pumping any overflow water to the proposed irrigation system. Low flows in North Thompson Creek cannot assimilate this overflow without degradation to the stream.

Anschutz Mitigating Measure 5 II11Coal will be hauled only during daylight hours.

Analysis of Effectiveness

Anschutz Mitigating Measure 1

In the mining plan, Anschutz proposes that the conveyors and transfer points be controlled by water spray, with an estimated 50 percent efficiency. By adding a surfactant to the spray system for longer-duration dust suppression, an estimated 85 percent reduction can be achieved. The use of a surfactant would reduce emissions from these two sources by 212 tons per year.

Anschutz Mitigating Measure 2

The 10-mile section of existing unpaved haul road/access road from the mine to the Pitkin County line would be watered frequently under the proposed mining plan. This would reduce emissions from both haul trucks and passenger vehicles an estimated 50 percent. If the road were treated with an appropriate stabilization chemical, emission reductions with continued watering would improve to about 85 percent. This 10-mile section of road would emit 3,172 tons per year with watering alone, 952 tons per year with chemical stabilization.

Anschutz Mitigating Measure 3

Cement retaining walls along the stream area should mitigate all hazards due to flooding.

Anschutz Mitigating Measure 4

The proposed reservoir and irrigation system would mitigate the excess mine water that would otherwise be discharged to the stream under the comapny's NPDES permit. Reservoir storage and irrigation use of excess water from the mine site would be a very effective method for protecting aquatic life in North Thompson Creek.

Anschutz Mitigating Measure 5

Reducing the number of vehicles on the road during the dusk to dawn hours would reduce the road kills by an unquantifiable number.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by the construction and operation of Anschutz Coal Corporation's proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

The application of the mitigating measure discussed in the previous chapter would significantly reduce annual particulate emissions from the Thompson Creek mines. In calculating the emission reductions, it was assumed that a surfactant would be added to the water spray used on the conveyor and transfer points, rather than using water or foam for dust suppression. This would result in a 70 percent emission reduction in addition to the reduction from the water spray alone. Chemical stabilization of haul and access roads also would produce a 70 percent emission reduction over that gained by the proposed watering. Table A5-A presents the total annual expected emissions for each study year that would result from the mitigating measures. This reduction in annual emission would reduce the air quality impact. Because of the modeling procedure used, short-term maximum concentrations should decrease in direct proportion to emission reductions.

Annual average concentrations for the study area were predicted with the model discussed in chapter 3, substituting the reduced emissions obtained with the mitigating measures. Since the conveyor, transfer points, and haul/access roads represent the major proportion (91 percent) of emissions and because these sources are spread out over such a large area, a total impact reduction of almost 70 percent would be realized over the entire area. Maximum 24-hour impacts would decrease to 52.5 micrograms per cubic meter ($\mu g/m^3$), while maximum annual impacts would be reduced to 15.5 $\mu g/m^3$

Geologic and Geographic Setting

Topography

Adverse environmental impacts would be limited to minor alteration of the land surface due to subsidence and long-term use of the refuse disposal area. Subsidence on the mine property would be limited to a maximum of 3.5 feet, which would occur over the easternmost longwall panels. Subsidence over most of the lease area would be significantly less than the 3.5 foot maximum. The possibility of the occurrence of open surface fratures or broken surfaces is small.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

Mineral Resources

The mining of the coal under the Anschutz proposal would deplete a nonrenewable energy deposit. Based on company plans to produce approximately 1 million tons of coal annually from 1980 on, the proposed Anschutz project would last 30 years, or until 2008. Production of the estimated 33 million tons of recoverable coal under the Anschutz proposal would represent approximately 9.9 percent of the total reserves over 42 inches thick of the Carbondale field. Because of the nature of underground caving and resultant high contamination from mining, future recovery of the unrecoverable 50 percent of the Anderson and A seams reserves is not considered feasible under present mining technology, and therefore those coal reserves must be considered as lost.

Water Resources

New consumption of water from North Thompson Creek during periods of low ground water yield may significantly affect the water supply of the stream. Based on past flow records and possible requirements from North Thompson Creek, in any given year Anschutz would consume all of the flow of the stream on four consecutive days of record.

Consumption of significant quantities of water from North Thompson Creek would decrease the dilution factor of the system, causing an increase in the concentration of organic and chemical constituents of approximately 20 to 30 percent with the consumptions of 30 percent of the flow. This in-

crease may be very significant to the aquatic environment.

There would be an increased consumption of municipal water of 275 acre-feet per year in 1980, 284 acre-feet per year in 1985, and 314 acre-feet per year in 1990.

Soils

Existing disturbance on approximately 46 acres at the mine site and proposed disturbance of ap-

TABLE A5-A

TOTAL ANNUAL PARTICULATE EMISSIONS

(ton/yr)

Study year	Without mitigating measures	With mitigating measures	Percent reduction
1980	3,631	1,199	67
1985	3,631	1,199	67
1990	3,631	1,199	67

proximately 40 acres at the rail loadout would cause an increase in erosion and a deterioration of soil structure and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would prolong the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 60 acres by 1980, 62 acres by 1985, and 68 acres by 1990 from a production function. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine and loadout sites on 86 acres. If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than these figures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action.

Wildlife

As the result of surface facilities, wildlife habitat on 46 acres would be destroyed for the life of the mine. These areas could have supported 6 deer and 18 elk annually. Reduced wildlife use would occur on an additional 240 acres through 1990.

Aquatic Biology

Several aspects of the present operation of the Anschutz mines would continue to adversely affect the fishery in North Thompson Creek if they are not corrected as previously described in chapter 3. These include the direct discharge of mine water to the stream, the entry of sediment into the stream from old spoils piles, fill slopes and roads, and the potential overflow of runoff and sewage retention ponds directly into the stream.

Secondary changes in the watershed of the Crystal River from increased human population and increased fishing pressure on the Carbondale area waters are unavoidable adverse impacts.

Cultural Resources

Archeology

Unavoidable adverse impacts could occur by damage to unknown sites from surface disturbance and through loss of information as a result of vandalism and illegal collecting.

Historic Resources

Those sites located in the vicinity of the mine (Union Mine Coke Ovens, Aspen and Western Railroad, etc.) would be impacted by vandalism and visitor use.

Transportation

Traffic would increase in the Carbondale area. Traffic on the road to the mine could reach 260 trips by employees and 286 coal truck trips per day. Rail traffic and congestion would increase by two trains per week. A small increase in passenger traffic at area airports could be expected.

Recreation

If the community recreations facilities needed to prevent deterioration of existing facilities are not provided, this deterioration would be an unmitigated impact. The lowering of the aesthetic character along the coal haulage route and the increased hazards to recreational users of this route would also be unmitigated impacts.

Visual Resources

During the mining period, there would be a definite impact on the natural landscape character since visually incongruous elements of the proposed action cannot be mitigated. Plant and refuse areas would remain apparent in the landscape for the life of the mine. Once all structures have been removed and the disturbed landforms have been regraded and revegetated, visual impacts would be minimal.

Socioeconomic Conditions

The development of the Anschutz mines would cause unavoidable population growth pressures in Garfield County, and particularly in the town of Carbondale. An increase of 700 people by 1980, 725 people by 1985, and 800 people in 1990 in the Carbondale area would be an increase of about 20 percent over the existing population. That same area, however, has more than doubled in population since 1970, while managing to minimize many of the adverse effects normally attributed to such a rapid rate of population growth.

The costs of accommodating new population resulting from the development of the Anschutz mine would be offset, for the most part, by an increase in locally derived revenues. It is difficult to predict, however, how much additional growth pressure there would be in southern Garfield County from recreation and oil shale development. In the past, Carbondale has provided affordable housing

to service workers employed in the area's recreation industry. The influx of new mining personnel would increase housing prices in Carbondale and displace some of those service workers, on lower incomes, who have sought housing there. This situation would make it more difficult to attract the required number of service workers needed to support the recreation industry in Aspen and Glenwood Springs.

About 60 acres of land in 1980, 62 acres in 1985, and 68 acres in 1990 are expected to be needed to support population growth resulting from the Anschutz operation. Much of this land requirement would be met by converting irrigated agricultural land, which surrounds Carbondale, to urban purposes.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 33 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment.

There would be the following alterations over the short term, a period beginning with on-site construction and ending with end of mine life (about 2008) and post-mining reclamation:

1. An estimated 33 million tons of coal would be exported to the west for metallurgical use.
2. There would be a continued loss of soil and vegetative productivity on 86 acres through 2008.
3. Wildlife habitat on 46 acres, which would have supported six deer and eighteen elk annually, would continue to be lost through 2008.
4. New consumption of water from North Thompson Creek during periods of low ground water yield may significantly affect the water supply of the stream. Based on past flow records and possible requirements from North Thompson Creek, in any given year Anschutz would consume all of the flow of the stream on four consecutive days of record.
5. Rail traffic and congestion would increase by two trains per week.
6. Plant and refuse areas would remain apparent in the landscape through 2008.
7. Total direct, indirect, and induced income generated by this project would be $8,075,200 by 1990.
8. The impact of mining activity would increase the level of concentration by a maximum of 16 micrograms per cubic meter ($\mu g/m^3$) in a small area on-site, and 1 to 5 $\mu g/m^3$ surrounding the mine site and along the haul road. Based on these concentrations, total annual average concentrations are predicted to reach a maximum of 40 $\mu g/m^3$. The predicted concentrations are well below the primary and secondary air quality standards for suspended for particulate of 75 and 60 $\mu g/m^3$, respectively.

Residual effects of mining (after post-mining reclamation) on long-term productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.
2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.
3. An estimated 33 million tons of coal, a nonrenewable energy resource, would be depleted after 2008.
4. There would be an increased consumption of at least 314 acre-feet of municipal water per year through 2008 and beyond.
5. Consumption of significant quantities of water from North Thompson Creek would decrease the dilution factor of the system, causing an increase in the concentration of organic and chemical constituents of approximately 20 to 30 percent with the consumption of 30 percent of the flow. This increase may be very significant to the aquatic environment.
6. Soil and natural vegetative productivity would be permanently lost on 68 acres due to urban expansion.
7. Surface construction, subsidence, and vandalism would disturb or destroy an unquantifiable number of nonrenewable cultural resources.
8. Archeological survey and excavation could provide gains in understanding of prehistoric use in the area.
9. Those historic sites located in the vicinity of the mine (Union Mine Coke Ovens, Aspen and Western Railroad, etc.) would be impacted by vandalism and visitor use.
10. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present facilities would be a long-term adverse impact.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 33 million tons of coal would be recovered from the Anschutz mines. About 33 million tons would be lost due to current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 86 acres for the life of the mine, and irreversibly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 46 acres, which could have supported 6 deer and 18 elk per year, would be irretrievably lost for the life of the mine.

Anything other than in-place preservation of archeological artifacts involves an irreversible, irretrievable commitment of the resource. Damage from surface disturbance or vandalism would result in a permanent loss of information and would remove archeological values from future research considerations.

Those historic sites in the vicinity of the mine (Union Mine Coke Ovens, Aspen and Western Railroad, etc.) could suffer irreversible damage by vandalism.

An irretrievable commitment of capital and land (at least 68 acres) would be required to support population growth.

Particulate air quality at the proposed mine site would be subject to an increase in concentrations. Air quality would be temporarily degraded during the mine life, but the change would not be irreversible. With termination of mining activity in 2008, air quality would return to the premining level of about 25 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean from the levels during mining of 35 to 65 $\mu g/m^3$.

Reduction in visibility would occur in proportion to the increased particulate concentrations. However, this loss of visibility near the mine site would also be reversible following completion of the mining activities.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan is not approved. Rejection of the Anschutz Coal Corporation's proposed M&R plan would result in no environmental impact from coal mining on federal leased lands. Since these lands are public lands and national forest systems land, surface use would be governed by Bureau of Land Management (BLM) and U.S. Forest Service (USFS) policy and management guidelines and decisions. Anschutz could submit a new M&R plan, challenge the rejection, or abandon development of the lease. Since Anschutz' mining plan involves other adjacent private holdings, it is probable that the company would still mine 15.5 million tons of coal through 1990 from its private coal (5,326 acres) since no federal action would be required.

Coal from the proposed mine is intended to supply 33 million tons of coal to western metallurgical markets. The 15.5 million tons produced from private reserves would supply only half of these markets. Other coal would have to be acquired, which would create a shortage for other coal markets.

Anschutz' private operations will increase annual average particulate concentrations by 40 micrograms per cubic meter ($\mu g/m^3$) in only a very small area on the mine site northeast of the preparation plant and parallel to a short section of haul road. Concentrations are predicted to increase by at least 20 $\mu g/m^3$ on both sides of the haul road. Concentrations of 10 $\mu g/m^3$ are predicted at distances of 0.7 to 1.5 miles from the haul road.

The highest 24-hour concentrations of 159 $\mu g/m^3$ and 132 $\mu g/m^3$ are predicted to occur northeast of the preparation plant and near the haul road. Maximum concentrations will decrease rapidly with distance from the haul road. At 1 mile on either side of the road, predicted maximum concentrations are in the range of 30 to 40 $\mu g/m^3$.

The estimated reduction in visual range to the north as a result of mining emissions will be about 18 miles on an annual basis. However, along any other line of sight (east, west, or south) concentrations will be increased an average of about 8 $\mu g/m^3$ over the same distance and therefore visibility would be reduced by about 9 miles.

An unquantifiable amount of additional consumption of both surface and ground water will occur. There will also be increased pressure on the municipal water supply systems in the area due to population increases associated with this mine.

During low flow months North Thompson Creek will be vulnerable to loss of fisheries due to changes in water quality. If the discharge of mine water continues as it was occurring at the time of the study then the stream will be degraded by increased total dissolved solids, sulfate, and iron. Occasional increases in turbidity in the stream from old coal spoils piles and from surface runoff from facilities and mine road will decrease the productivity of aquatic insects and trout species in the stream.

At full production mine water discharge will cease. At this time diversion of 0.20 cfs may partially dewater the stream in late summer and cause a proportional loss of the fishery. A refuse water storage reservoir has been proposed, and if it is built it would eliminate direct discharge of mine water to the stream. This would help to return the aquatic habitat to a more normal condition. The potential for extensive degradation of North Thompson Creek from retention structure failure will exist as long as the facilities remain on the site.

Anschutz' proposed rail loadout facility at Carbondale would disturb 40 acres of irrigated and nonirrigated pasture. In addition, urban expansion caused by population increases related to coal mining would result in the disturbance of an estimated 60 acres of vegetation by 1980, 62 acres by 1985, and 68 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers. All of this disturbance may adversely affect the livestock industry in the area because these lands are used as livestock wintering areas and the hay harvested from them in the summer is used to feed livestock during winter. The loss of them may result in hardship on some livestock operators.

Increased numbers of people in the area would also result in additional disturbance of native vegetation, particularly by off-road-vehicle use. This disturbance would lessen the productivity of native

vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Wildlife habitat on 86 acres would be lost because of, refuse piles, settling ponds, and additional road development; the quantity and quality of habitat available to aquatic species would be reduced by reduction of downstream flows; and road kills could increase because of the increase in coal truck traffic and miners' vehicles. In addition, increased human populations would cause urban expansion onto agricultural lands and some winter range, as well as an increase in legal and illegal harvest of wildlife. Increased recreational activity would cause additional stress to animals and some loss of animals.

Subsidence or vandalism would destroy or disturb an unquantifiable number of cultural resources. Pleontological resources would be impacted both adversely and benefically in approximate proportions to the level of regional development and the area disturbed.

The final designations given to the U.S. Forest Service RARE II roadless area and the BLM wildland study area will affect recreation on these sites. Should wilderness designations be given, travel and recreation would be restricted to nonmotorized forms.

Increased propulations in Garfield County by 1990 would require 87 additional acres of community active/improved parkland (e.g., ballfields, playgrounds, tennis courts, to prevent overuse and deterioration of existing facilities (Bickert, Browne, Coddington, and Associates, Inc., 1977).

The continued operation of the existing mine for private coal development would result in continued landscape modification for refust, storage, etc., and truck use of the Jerome Park road. Residential expansion on the private lands is possible, based on projected population increases in Garfield and Pitkin counties and the lure of the natural amenities of the area. The North Thompson Creek area would retain a modified natural appearance but with increased cultural modifications.

Garfield County is projected to grow at a rapid rate to 33,884 people in 1980, 41,663 people in 1985, and 45,238 people in 1990 primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale develpment.

Mining of Anschutz-held private coal would cause Garfield County population to increase by 800 in 1990 (or less than 0.02 percent of total projected growth). Develpment associated with Anschutz by 1990 would require a total of 267 housing units in the county, would increase school enrollemnt by 100 students (primarily in the Roaring Fork School District), and would increase employment in the county by 653 people. No other new mining development is propoed for this area at the present time.

Recreation-related development is expected to continue to exert population growth prssures on Carbondale, Basalt, and Aspen.

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transport, and rates of production have been considered, but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geologic and geographic characteristics of the area. Any new alternatives which are presented during the review process will be carefully considered.

ATLANTIC RICHFIELD COMPANY:

MT. GUNNISON NO. 1 MINE

Chapter 1

DESCRIPTION OF THE PROPOSAL

Proposed Action

The proposed action is the review and consideration for approval of a mining and reclamation plan (M&R plan) submitted by Atlantic Richfield Company (ARCO) to the Area Mining Supervisor of the U.S. Geological Survey (USGS) Denver, Colorado, on August 4, 1976. The M&R plan has been accepted by the USGS as suitable for use in preparing this environ mental statement (ES) and is available for public review at the Area Mining Supervisor's Office in Denver.

This M&R plan was submitted for review prior to promulgation of the initial regulations, (30(CFR): 700 required under Section 502 and 523 of the Surface Mining Control and Reclamation Act (SMCRA) of 1977 (PL 95-87) and has not been officially reviewed for compliance therewith. Therefore, the applicant's plan may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations.

The M&R plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plans are revised and returned to USGS they will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The M&R plans cannot be approved until they conform to all applicable federal requirements.

The plan describes the proposed Mt. Gunnison No. 1 Mine, which would be located approximately 1 mile east of the town of Somerset in Gunnison County, Colorado (see map AR1-1). The Mt. Gunnison No. 1 Mine would be a new underground bituminous coal mine with an anticipated annual production of 2.5 million tons and a mine life of 27 years, employing 565 people at full production. Production would be from existing federal coal leases C-1362, C-0117192, D-044569, and adjacent private coal leases totaling 12,579 acres.

As yet, no commitment for sale of the coal from the Mt. Gunnison No. 1 Mine has been made; however, marketing of the coal is being actively pursued. It is anticipated that ARCO would secure a contract for the coal from an unspecified out-of-state utility. The coal would be trans ported by rail.

History and Background

On September 1, 1967, Atlantic Richfield Company (ARCO) was awarded federal coal lease C-1362, containing approximately 4,835 acres in the North Fork Valley area. On April 1, 1969, ARCO acquired by assignment federal coal lease C-0117192, containing approximately 1,245 acres adjacent to C-1362. This lease was originally issued to Harrison Eiteljorg on June 1, 1965, and subsequently assigned to Reliable Coal and Mining Company on January 1, 1967.

In late 1969, ARCO began negotiations with the Bear Coal Company to acquire federal lease D-044569, issued to Bear Coal Company in August 1934. Agreement was reached in January 1970, and ARCO acquired an option for the Bear surface and leasehold estate, containing approximately 1,380 acres. The option was exercised in January 1971, and the lease was assigned to ARCO effective April 1, 1971. An additional 230 private acres were also purchased. By acquiring federal lease D-044569, ARCO obtained access to rail and highway facilities in the North Fork Valley, suitable land for future plant facilities, and additional coal reserves.

In 1974, ARCO obtained a lease from Mt. Gunnison Fuel Company for 3,800 acres of private coal reserves contiguous to the three federal leases. From 1972 to 1976, ARCO acquired an additional 120 acres of private surface and mineral rights and 1,370 acres of surface rights overlying both its federal and private coal reserves. In sum, the total acreage held by ARCO is now approximately 12,578 acres.

The federal lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.

The Bear Mine, currently the only mine producing from the Mt. Gunnison properties, began production in 1932 and has produced continuously since that time. Total production from 1932 to 1976 was 2,871,747 tons. In 1976, ARCO extended an abandoned prospect entry in Sylvester Gulch as a test project to obtain a bulk-coal sample and to study roof and floor conditions.

Presdisturbance Inventories and Analysis

Ecology Consltants, Inc., Fort Collins, Colorado, completed an ecological study of the Mt. Gunnison No. 1 Mine area for ARCO from October 1975 through July 1976; the final report was submitted September 1977. The report covered inventories for rare and endangered vegetation, wildlife, and aquatic life, finding no listed species on the area. The US Soil Conservation Service has completed mapping of private and public land in the Paonia-Somerset area (Upper North Fork Valley) but results have not yet been published. Soils of the US Forest Service land in the area have not been mapped as yet. An archaeological and historic resources study was done for ARCO by the Department of Anthropology, Fort Lewis College, Durango, Colorado; the report was submitted March 1977.

Stages of Implementation

ARCO proposes to begin producing 500,000 tons of coal per year by 1982. During the first project year (1980), approximately 130 employees would be used to start construction of the portal and surface facilities. Construction would continue through the second project year (1981), and preliminary development of the mine would start about the middle of the year; approximately 200 employees would be needed. Production would increase stepwise until the fifth year (1984), when the anticipated annual production of 2.5 million tons would be reached. At full production, the Mt. Gunnison No. 1 Mine would employ approximately 565 people.

Production would begin in the F seam of the Mesaverde group. Extensive exploratory drilling has revealed the presence of five additional underlying coal seams; two, the E and B seams, are mineable by current technology.

Mine Layout

The initial development of the main entries would begin at the outcrop just west of the property line between Sections 15 and 16 (see map AR1-2). Eight entries would be driven in a southerly direction adjacent to the section line. At 4,500 feet in from the portal, six bleeder entries would be turned to the west. The first set of submain entries would be developed about 3,000 feet from the end of the bleeders, with the first production panels developed from these submain entries.

The main entries would continue south along the property line for approximately another 4,000 feet, leaving a square block of coal in Section 16 for longwall panels. At this point, the main entries would be turned southwest and driven updip. From here, all workings would be parallel to and perpendicular to the main entries. The headgate and tailgate entries would be driven downdip and panels retreated updip.

Tentatively, the center-to-center dimensions of the pillars would range between 60 and 100 feet, with entry widths varying between 14 and 18 feet. Both pillar and entry designs may be subject to unforeseen underground conditions which could cause deviation from the designated plan.

Roof control in the Mt. Gunnison No. 1 Mine would be achieved by beam action and arching. Roof support practices which may be incorporated into the plan include mechanical roof bolts, roof trusses, resin anchored bolts, timbers, steel cross bars, guniting, yieldable arches, crossbars, and wire mesh. To provide support on longwall sections, powered, self-moving hydraulic jacks with roof canopies or shields would be used together with timbering and roof bolting in the development entries.

Each working section of the mine would have an approved roof support plan to provide protection under the anticipated conditions. This plan would be supplemented by additional support if loose or badly sagging roof is detected or where unconformities are discovered. For support of long-life haulways, air courses, substations, overcasts, track intersections, and other permanent or semi-permanent places, additional support would be installed as required because contact with the atmosphere causes the roof to weaken.

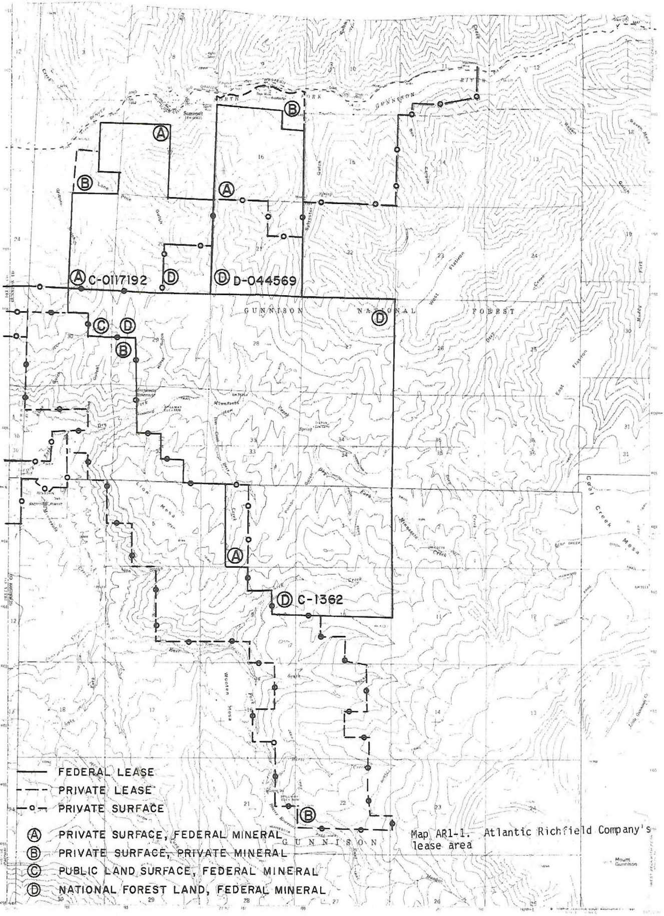
One area of intense design would be support for the main entries under areas of low overburden. Because of potential problems with sloughing and poor roof bolt anchorage, the first 200 feet of main entries would probably be protected with additional support.

Panel orientation would parallel the major fracture system of the area. The resulting horizontal stresses, measured in the C seam, should enhance caving behind the longwall face and improve mining conditions, recovery, and safety.

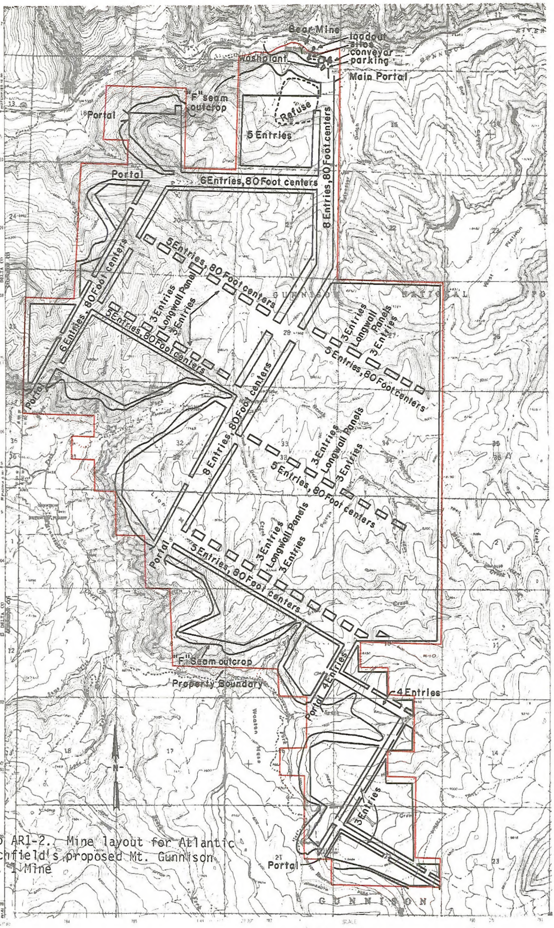
The first longwall system would go into operation after development of the first longwall panel. Full anticipated production would be reached with the development of the second longwall panel. Barrier pillars, located in various sections of the mine, would be extracted in the retreat phase of the mining sequence.

The following is a listing of the major mine equipment:

Continuous miner
Shuttle car
Roof bolter
Feeder breaker
Auxiliary fan
Rock dusters
Longwall shearer
Pan conveyor



Map AR1-1. Atlantic Richfield Company's lease area



Map AR1-2. Mine layout for Atlantic Richfield's proposed Mt. Gunnison No. 1 Mine

Hydraulic power supply
Stage loader
Water pump
Panel conveyor
Submain conveyor
Mantrip
Personnel carrier
Supply locomotives
Jitney
Miscellaneous equipment
Mine fan
Main conveyor
Longwall supports

The longwall supports would be hydraulic. All of the rest of the equipment would be electrically powered.

VENTILATION

The majority of ventilation air would enter the mine through the initial development entries. Axial exhaust fans would be installed at the portal. As the mine advances to the south, additional intake openings may become necessary.

The fresh air would travel through three intake entries of the main entry system and split as required at the submains. The submain entries would provide two intake airways to the panel entries, which would provide one fresh air intake during development and two fresh air intakes during longwall production. In the development sections, the air would split into two returns to minimize the time that a miner would be exposed to dust from equipment operation. The air would be regulated on each return split at the sections. The return air would move from the production sections, through the submain returns, through the main returns to the primary mine fan(s).

The anticipated ventilating pressure requirement would be in excess of 10 inches of water to provide approximately 321,000 cubic feet of air per minute. Additional fans may be installed at remote points as needed.

Face ventilation would be improved by providing brattice or auxiliary fans with tubing. All intake entries would be separated from return entries by permanent stoppings, with doors where required, overcasts, and undercasts. All intake escapeways and belt entries would be isolated by plastered block stoppings or the equivalent. Conveyor entries would be ventilated by a separate split of low velocity air.

HAULAGE SYSTEM

Coal would be transported from the working sections to the surface via conveyor belts. Tentatively, panel conveyors would be standard 42-inch-belt width, and each would be limited in length to assure effective tensions and motor size within acceptable limits. An effective belt control system is planned to assure that the submain conveyors would not be overloaded by coal from more than one section. The main line conveyor would be of sufficient capacity to handle material from the submain conveyors. Favorable grades would prevail throughout the main line haul.

Dust would be suppressed by water sprays located over critical areas of the conveyor. Spillage would be controlled by good housekeeping and by proper design. Fire detection and suppression equipment would be located along the conveyors to ensure adequate protection. State and federal regulations concerning belt safety and protection would be complied with. For accessibility and safety, crossovers and walkways would be established along the conveyor; riding the belt would be prohibited.

During the first year of production a supply track system, using a direct current trolley, would be started in an entry generally adjacent to the belt conveyor entry; it would be maintained throughout the life of the mine. Battery-powered supply locomotives and personnel carriers would be available for major equipment moves and emergencies. The supply track would be constructed with proper grading and ballast to handle large equipment and other heavy loads. Battery-powered personnel carriers would be provided for construction crews, supervisors, and mechanics.

Surface Facilities

Approximately 140 acres would be required for surface facilities, which would include support buildings, a preparation plant, loadout facilities, a railroad siding, a refuse disposal plant, an electrical substation and 115-Mw transmission line, a water and sewage treatment plant, access roads, and additional portals. In addition, a supply storage yard and a parking facility of 3 to 4 acres would be constructed. The majority of the required acreage would be on private land.

SUPPORT BUILDING

The mine office, bathhouse, warehouse, and shop buildings would be constructed near the portal area using standard engineering practices. The office building would be approximately 13,000 square feet in size and located below the portal facilities.

PREPARATION PLANT

To fulfill coal contract requirements, ARCO plans to construct a coal preparation plant capable of handling 2.5 million tons of raw coal per year. The plant would cover approximately 15 acres. Coal from the F seam would be transported by belt conveyor to an appropriately sized bin on the surface. The coal would be moved by belt conveyor from under the bin to the top of a raw-coal silo adjacent to the preparation plant. A tramp iron

magnet, located above the conveyor drive pulley, would remove scrap iron mixed with the coal. From the bottom of the silo, coal would be fed into surge bins large enough to provide an even flow of raw coal into the preparation system.

Coal from the surge bins would be fed at a constant rate by vibrating feeders onto a vibrating grizzly (sizing screens) for initial 1.5-inch size separation. The minus 1.5-inch material would go directly as raw coal to single-deck, dry sizing screens. The plus 1.5-inch material would be crushed in a rotary breaker. Any plus 1.5-inch material remaining after this process would go to the refuse bin. Crushed material then would go to the dry sizing screens. The plus 1.25-inch material from the screens would pass directly to a jig for further processing; the minus 1.25-inch material from the screens would go directly to the coal storage silos.

Jigging would separate the material into two products: (1) wet coal with associated fines and (2) refuse. The wet coal then would be conveyed to vibrating screens for dewatering and sizing into plus and minus 1.25-inch fractions. The plus 1.25-inch coal would be fed to a crusher for reduction to minus 1.25 inches and then be conveyed to the clean coal silos. The minus 1.25-inch coal from the jig would be fed to mechanical dewatering centrifuges for removal of surface moisture before being conveyed to clean coal storage. Refuse produced from the jig would be screened for two products: oversized material, which would go to the refuse bin, and undersized material, which would enter the thickener.

The thickener would receive undersized waste from the centrifuge and waste water from the screens. Overflow (clarified water) from the thickener would reenter the preparation water cycle, and the underflow would enter a filter for dewatering before disposal in the refuse pile. Water from the filter would enter the thickener for reuse.

The system described above would reuse water from previous washing in a closed circuit cycle. The only water loss from the plant would be moisture in coal and refuse. Make-up water would be added to the system as necessary from the storage facilities, making it a net user system. However, should an unforeseen malfunction release process water into the environment, a catch basin would divert the accidentally released process water into settling ponds to be constructed near the preparation plant. If it should become necessary to empty thickeners, filters, etc., for maintenance, the effluent would be emptied into the lagoon located near the plant. This effluent would be treated as necessary to prevent degradation of the environment.

Dust would be controlled to within state and federal air quality standards. Dust suppression and/or collection equipment would be located at potential sources of airborne dust, such as belt transfer points, crushing stations, and raw coal screens.

Production schedules and the need to use unit trains would also require construction of four steel-reinforced concrete storage silos to hold coal temporarily at the mine site.

Loadout Facilities

Coal from the preparation plant would be taken by conveyor to two 10,000-ton storage silos to be located just south of the North Fork River. Coal would be conveyed across the river to a sampling house and railroad car loadout station positioned over the rail siding. The loadout facilities would cover approximately 15 acres.

Railroad Siding

The proposed mine area is currently served by an existing spur line owned and operated by the Denver and Rio Grande Western Railroad Company (D&RGW). As part of the coal handling facilities, a new railroad siding approximately 10,000 feet long, covering approximately 23 acres, would be constructed. The new siding would be built within the existing D&RGW railroad right-of-way between Highway 135 and the North Fork. The siding trackage would be of standard design, conforming to American Railroad Engineering Association standards. The need for acquiring an additional right-of-way would be determined after further negotiations with the railroad company.

Refuse Disposal

The total volume of F seam refuse would be approximately 8 million tons or 186,364,537 cubic feet over the 27-year life of the F seam mine. The total refuse produced per year is not expected to exceed 400,000 tons. This is a calculated 14-percent-by-weight of run-of-mine coal. The refuse disposal area would cover approximately 50 acres in Section 16.

Refuse would be conveyed by belt conveyor from the preparation plant to a large flat plateau 650 feet above the North Fork. The refuse disposal area would cover approximately 29 acres by 1990. The refuse would be laid down, spread, and compacted in maximum 2-foot lifts; particular attention would be paid to compacting the edges. Fine refuse would be blended with coarse refuse to fill voids during compaction and prevent oxidation. Twenty-five lifts would make up a stage, approximately 50 feet in depth. Additional stages would be offset from the front edge of preceding lower stages by 30 feet, reducing the ultimate slope and providing terracing along the face of the refuse pile for vegetation and rehabilitation. Each lift would be sloped at 3 degrees into the hillside to diversion ditches to control runoff water during construction of the embankment. Each terrace would be sloped

at 2 degrees into the base of the next layer to form a water collection ditch. The slope angle between terraces would not exceed 27 degrees (51 percent), the maximum allowed by law without providing an added safety factor.

Certain safety features would prevent sliding of the refuse pile. The large area of low-degree slope at the foot of the embankment should greatly increase its inherent stability. Under the toe of the initial stage, a blanket drain arrangement approximately 10 feet deep would be keyed into the hillside. This drain would provide a filter for any water draining through the pile, providing sediment control as well as stability for the toe of the bank. A 10-foot-deep by 10-foot-wide trench across the hill at the base of the embankment would prevent the bank from creeping. The excavated rock would be utilized to form a wall in front of the trench, and the trench would be filled with crushed rock as filter material. Slope stability under all adverse conditions would be fully analyzed during final engineering.

Surface runoff is expected during storm activity and snowmelt periods. Drains under the stages and across the terraces would empty into encircling ditches around the entire disposal area to minimize water infiltration into the embankment and to reduce the possibility of acidic leaching of the embankment material. Measures would be taken to prevent any drainage water force from undermining the embankment structure. Temporary diversion ditches would be constructed on the uphill side of the embankment to minimize water flow into the refuse. The drainage system would be designed to handle 6-hour, 100-year storms, as suggested by the Mining Enforcement and Safety Administration, to prevent impounding of water behind the embankment. Since this water from the watershed would normally empty into the North Fork, there should be no decrease in water quality. All hydraulic facilities would be designed in compliance with the federal and state regulations.

Water runoff from the embankment itself and from the drains would be monitored and, if necessary, treated before being discharged into the North Fork. Therefore, these facilities would be designed to divert the runoff directly to the water treatment plant if necessary, with temporary storage planned for excess amounts during storms. After completion of embankment construction, a permanent drainage diversion system would be incorporated.

Water Supply and Distribution

At the designed production level of 2.5 million tons of coal per year, the Mt. Gunnison No. 1 Mine would require 960 acre-feet of water annually. In order to meet this water need, ARCO has obtained water rights from the sources listed in table AR1-1.

Water would be pumped from the source to storage facilities. These facilities would provide a continuous supply of water for the mining operations in addition to a reserve capacity. Water from storage would be circulated throughout the mine in high pressure lines ranging from 75 to 250 pounds per square inch (psi). High pressure flow would be provided by gravity or pumps.

A potable water treatment plant may be constructed to provide potable water for mine and plant use.

Preparation plant water and contaminated drainage water would be treated, if necessary, to meet all applicable federal and state discharge regulations. Probable treatment would be in the form of an appropriately sized package aeration plant, or aerated sewage lagoons. The sewage treatment facilities would produce clarified water and sludge. The clarified water would most likely be chlorinated and discharged into the North Fork of the Gunnison River.

Power Facilities

The power for underground use would be transformed from 115 Mw to 13.2 Mw for distribution. The necessary substation transformers and switch gear would be located on the plant site close to the major load centers. The electric power would be supplied to the site by a new 115 Mw transmission system or the Delta-Montrose Electric Association. This high voltage power would be reduced to appropriate lower voltages at the point of use.

Access Roads

Currently, there is no all-weather access road to the proposed Mt. Gunnison No. 1 Mine location. ARCO plans to construct 1 to 1.5 miles of all-weather road on a standard 24- to 32-foot-wide section in accordance with applicable standards. The road would be limited to a vertical grade of 8 percent or less and would be paved with asphaltic concrete. The proposed access road would leave Colorado State Highway 133 and cross to the south side of the North Fork of the Gunnison River approximately 1.1 miles east of Somerset.

In-plant roads would be constructed with variable dimensions and specifications depending on their intended purpose. Permanent roads probably would not be paved unless maintenance costs versus capital costs, traffic volume, personnel safety, etc. indicate the need for paving.

Ventilation Portals

Two additional ventilation portals would be broken out in the Minnesota Creek drainage, one portal in 1983 and the other in 1990. Both portals would be used for intake air only. No equipment is

anticipated at either portal so no roads would be needed. Both portals would disturb an area that should not exceed several hundred square feet total.

Surface Reclamation

For surface disturbance resulting from coal mining operations at Mt. Gunnison No. 1, pursuant to 30(CFR): 717.11 and 30(CFR): 715.13, coal mining operations will be required, as a minimum, to restore the surface areas disturbed to a condition capable of supporting the use which it was capable of supporting prior to any mining, or higher or better uses of which there is reasonable likelihood. A mining permit will not be approved unless the applicant has demonstrated that reclamation to the proposed post mining land use can be accomplished under the reclamation plan contained in the mining and reclamation plan. ARCO would be responsible for backfilling any holes or cracks which may appear on the surface as a result of the subsidence.

The land within and adjacent to the proposed ARCO project area is used primarily for livestock grazing, wildlife habitat and outdoor recreation. The objective of the ARCO proposed reclamation plan is to restore land disturbed by mining to a use equivalent to or better than the highest previous use. Future use of the site is expected to involve livestock grazing at a level the land was capable of supporting before any mining occurred.

At the time of service-road and mine construction, topsoil would be removed and stockpiled for use in reclaiming the areas disturbed. After stockpiling, the top soil would be contoured and planted to native or adapted varieties of grasses to control erosion and help prevent deterioration of the soil.

When the Mt. Gunnison No. 1 Mine is abandoned all surface structures would be removed and either salvaged or buried. The site would be graded to conform to the natural terrain, top-dressed with a suitable material and seeded.

Authorizing Actions

This mining and reclamation plan (M&R plan) was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Section 502 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87). Therefore, this plan does not fully reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan was designed using the requirements of the initial regulations. Before the plan is forwarded for approval by the Secretary of the Interior, it will be returned to the mining company

TABLE AR1-1

ARCO WATER RIGHTS

Source	Acre-feet
Mt. Gunnison Pipeline	10,859.50
Mott Land and E. L. Brown Ditch	0.50
Roeber Reservoir	44.00
Lucas Cline Reservoir	9.50
Turner Ditch Company	
Lone Cabin and Reservoir Company	0.25

for redesign to incorporate the applicable initial regulations.

As soon as the applicant's plan is revised and returned to the U.S. Geological Survey (USGS) it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations at 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is governed by the regulation 30(CFR): 715.15.

The standards and measures described in those regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

Bureau of Land Management (BLM)

Before approval of the M&R plan is granted, BLM must concur with ARCO's proposal following redesign according to 30(CFR): 211 and 30(CFR): 700 regulations and review by USGS and OSM.

U.S. Forest Service (USFS)

Before approval of the M&R plan is granted, USFS must concur with ARCO's proposal following redesign according to 30(CFR): 211 and 30(CFR): 700 regulations and review by USGS and OSM.

U.S. Geological Survey (USGS)

USGS would, with BLM and USFS concurrence, approve the M&R plan.

Office of Surface Mining (OSM)

OSM would review the M&R plan and approve it along with USGS, with BLM and USFS concurrence.

Colorado Department of Natural Resources

Air quality, solid-waste disposal, water quality, and mining and reclamation of mined land must comply with rules and regulation administered by the various divisions with the Department of Natural Resources. Plans, permits and licenses to mine coal must be obtained from the state of Colorado.

Interrelationships

Relationship to Other Existing and Proposed Development

Presently 5 companies mine coal in the North Fork Valley. All 5 of these mining operations lie within an 8 mile radius of the proposed Mt. Gunnison No. 1 Mine. Table AR1-2 lists the 5 mines and their recorded or projected production for the years 1977, 1980, 1985, and 1990. The projected production for the Mt. Gunnison Mine is also shown for comparison. Production from the Mt. Gunnison Mine would constitute 40 and 45 percent of the total production for the North Fork Valley in the years 1985 and 1990 respectively.

Of the existing operations, only the Bear Mine would be directly affected by the Mt. Gunnison Mine. Bear Coal Company operates the Bear Mine under an operating agreement on federal coal lease D-044569, which is held by ARCO. Annual production from the Bear Mine for 1977 was 226,220 tons of coal. Surface facilities for the Mt. Gunnison Mine would partially replace those now used, and production from the Bear Mine would be stopped once construction of new facilities is begun. The areas would then either be reclaimed or converted for use by the new mine.

In addition, U.S. Steel, Empire Energy, and Gulf Mineral corporations hold currently inactive federal coal leases (see table AR1-3) in the North Fork Valley. The Federal Coal Leasing Amendment Act of 1975 requires that inactive federal coal leases be developed or forfeited. Diligent and continuous development criteria must be met by June 1, 1986. Table AR1-3 sets out minimum production requirements for these leases. Development of these leases would increase the mining activities in the area. Several coal companies also own private coal reserves in the area and have expressed their intention to expand any future operations onto adjacent federal coal. Table AR1-4 summarizes proposed production from the area.

All of the operating mines currently ship most of the coal produced out of the area by way of the D&RGW rail spur in the North Fork Valley. An average of seven unit trains and numerous multiple coal-car trains leave the North Fork Valley each week. Production from the Mt. Gunnison No. 1 Mine would increase the number of unit trains from seven to twelve each week.

All vehicular traffic in the area, as well as livestock, currently uses Colorado State Highway 133 as a major artery. Employee and service vehicular traffic related to the Mt. Gunnison Mine would increase the use of this highway. The Colorado Division of Highways is currently designing a new highway in the immediate area of the proposed mine. The existing highway has a very low safety rating, and in several places the D&RGW railroad crosses the highway, disrupting and blocking traffic flow.

Limited transportation, housing, and service facilities exist in the area, and development potential is small. The Mt. Gunnison Mine could be expected to compete with other mining operations in the

area for the limited facilities available, particularly with Colorado Westmoreland, Inc., in the Paonia area. (Figure AR1-1 is an aerial photograph showing some of the mines and leases in the area.)

Relationship to BLM abd USFS Management Plans

The area covered by ARCO's proposed mining and reclamation plan (M&R plan) includes 1,818 acres of private surface with underlying federal coal, 5,547 acres of national forest systems land administered by the U.S. Forest Service (USFS) with underlying coal administered by BLM, and 96 acres of public lands administered by the Montrose District of BLM.

The national forest systems land included in the M&R plan is administered by the Grand Mesa-Uncompahgre-Gunnison National Forest. The BLM's Alkali-North Fork MFP (completed in June 1976) is the principal land use plan for the subsurface mineral resource leased by ARCO.

The area encompassed by this proposal has been primarily used for livestock grazing, wildlife habitat, and hunting. Part of the area in ARCO's proposal includes the Bear Mine, which has been producing coal continuously since 1932. Approximately 1,200 acres of teh surface area administered by the USFS has been recently identified as having roadless area characteristics.

Figure AR1-1. Looking southeast at Somerset, Colorado, the Bear Mine (Bear Coal Company, and the Somerset Mine (U.S. Steel Corporation) on the North Fork of the Gunnison River. In the foreground, the area lying north of the river consists of the private coal leases of U.S. Steel. The two federal leases shown in the background (D-044569 and C-0117192), a third lease lying off the top of the photo, plus additional private coal leases constitute Atlantic Richfield's Mt. Gunnison Mine property. Federal coal lease D-52501 (Empire Energy) and the Edwards Mine also lie in the vicinity of Somerset. Kmv marks the coal-bearing Mesaverde formation, Km the Mancos shale, and Kmvr the Rollins sandstone member (basal) of the Mesaverde. The distance from A to A' is approximately 1 mile.

TABLE AR1-2

RECORDED AND PROJECTED PRODUCTION FROM THE NORTH FORK VALLEY FOR THE YEARS 1977, 1980, 1985, and 1990

Company	Mine Name	1977 Recorded Production (tons/year)	1980 Projected Production (tons/year)	1985 Projected Production (tons/year)	1990 Projected Production (tons/year)
Sunflower Energy Corp.	Blue Ribbon Mine	8,320	70,000	70,000	0
U.S. Steel Corp.	Somerset Mine	914,552	937,000	937,000	937,000
Western Slope Carbon	Hawksnest East Mine	190,349	350,000	750,000	750,000
	Hawksnest No. 3 Mine	12,362	0	0	0
Colorado Westmoreland Inc.	Orchard Valley Mine	286,129	700,000	1,250,000	1,250,000
Bear Coal Company	The Bear Mine	226,220	240,000	0	0
	Subtotal:	1,637,932	2,297,000	3,007,000	2,937,000
Atlantic Richfield Co.	Mt. Gunnison No. 1 Mine	0	0	2,130,000	2,500,00
	Total:	1,637,932	2,297,000	5,137,000	5,437,000

TABLE AR1-3

DILIGENT DEVELOPMENT CRITERIA FOR NORTH FORK INACTIVE LEASES

Lessee	Lease No.	Recoverable LMU* Reserves (tons)	Production before June 1, 1986 (tons)	First Year Production (tons)	Second Year Production (tons)	Annual Average Production (tons)
U.S. Steel	C-051669	14,775,000	369,375	147,750	147,750	147,750
	C-068389	7,563,000	189,075	75,630	75,630	75,630
	D-052558	3,780,000	94,500	378,000	378,000	378,000
Empire Energy	D-052501	5,400,000	135,000	54,000	54,000	54,000
Gulf Minerals	D-036955	2,800,000	70,000	28,000	28,000	28,000
		Totals:	857,950	683,380	683,380	683,380

Note: LMU = logical mining unit.

TABLE AR1-4

SUMMARY OF REPORTED AND PROJECTED COAL PRODUCTION FROM THE NORTH FORK VALLEY IN THE AREA OF THE PROPOSED MT. GUNNISON MINE

Development	Reported Production (tons) 1977	Projected Production (tons) 1980	1985	1990
1. Existing mining operations on private and federal coal leases (5 operations). See table AR1-2 a/.	1,637,932	2,297,000	3,007,000	2,937,000
2. Minimum production requirements for inactive federal leases. See table AR1-3.	0	0	0	683,380
3. Projected production from ARCO's proposed Mt. Gunnison Mine.	0	0	2,130,000	2,500,000
Total:	1,637,932	2,297,000	5,137,000	6,120,380

a/ In addition to the five companies listed in table AR1-2, several companies have announced their intent to develop private coal reserves which they currently lease or own. In some cases development of these private reserves is dependent upon leasing of additional federal coal.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, and cultural resources and the socioeconomic conditions which constitute the site-specific environment in which Atlantic Richfield Company (ARCO) proposes to develop federal coal and adjacent private coal. The description focuses on environmental details most likely to be affected by ARCO's proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, ,which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunderstorms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air movements.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Mt. Gunnison mine site is located about 10 miles east- northeast of Paonia in the North Fork Valley. The valley is quite narrow with steep sides and is oriented generally east-west at this point. Elevation at the proposed mine site is 6,280 feet.

Wind directions are not in line with the valley orientation because a smaller valley, Sylvester Gulch, empties into the North Fork Valley at the eastern edge of the site, lending a south-southeasterly pattern to the air flow (figure AR2-A). On-site meteorological data recorded wind speed during a six-month period of about 8 miles per hour. Wind speed and wind direction at the proposed mine site are very similar to that reported at the Grand Junction weather station.

Temperatures recorded at the Paonia station average 49 degrees Fahrenheit annually, and precipitation measures about 16 inches annually. The growing season is approximately 138 days each year (based on 32 degree freeze threshold data) and would be somewhat shorter at the mine site due to its higher elevation. Evaporation is estimated to be about 45 inches annually.

Air Quality

Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations range from 20 to 40 $\mu g/m^3$

The available particulate sampling data which best represent existing particulate air quality at the proposed Mt. Gunnison mine are from an on-site privately operated sampler. The annual geometric mean concentrations recorded at the sampling site in 1977 was 28 $\mu g/m^3$, with first and second maximum 24-hour concentrations of 94 and 69 $\mu g/m^3$ respectively.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutants near the proposed site. Since no major sources of these pollutants exist in the surrounding area, concentrations are considered to be at background or natural levels.

Visibility at the site ranges from less than one mile to approximately 100 miles throughout the year. Average visibility is about 54 miles with greatest visibility occurring during spring and summer months.

Geologic and Geographic Setting

Topography

The federal and private coal leases that compose the Mt. Gunnison No. 1 Mine property lie on the northwest edge of the West Elk Mountains (see map AR1-1). These leases extend from their northern boundary on the North Fork of the Gunnison

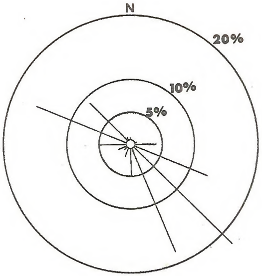


Figure AR2-A. Annual wind frequency at the Mt. Gunnison mine site

River to the intermediate slopes of Mt. Gunnison on the northern edge of the West Elks. Elevation varies from 5,900 feet along the North Fork River to over 9,200 feet at the southeast edge of the leases. Mt. Gunnison rises to 12,719 feet 2.5 miles southeast of the leases.

Along this portion of the North Fork River, the river is narrowly confined by the steep slopes of Grand Mesa to the north and the West Elk Mountains to the south. The lease area, lying completely south of the North Fork, consists of a major northwest trending ridge system with secondary northeast or southwest trending ridges. The ridges are separated by narrow gulches or canyons containing intermittent and occasionally small perennial streams. These streams flow either north into the North Fork of the Gunnison River or south into the Dry Fork of Minnesota Creek.

The maximum relief on the lease area is generally found along the escarpments of the North Fork River where slopes may reach up to 85 percent. The mesas along the western lease boundary provide the least relief with slopes at a minimum of 10 percent. The average slope throughout the lease area is approximately 30 percent.

Landforms

The landforms present on the lease area are largely the result of the differential erosion of the Mesaverde formation (sedimentary rock strata). Thick resistant sandstones, such as the Rollins sandstone member of the Mesaverde formation, form vertical to steep cliffs and escarpments. Shales and other less resistant beds form gentle slopes between the cliffs and ledges. Because of the predominance of sandstones in the Mesaverde formation, escarpments, sharp ridges, and narrowly cut canyons are the major erosional landforms of the area.

In addition, there are several landforms on the lease which represent both erosional and depositional process. Along the North Fork River, a narrow flood plain is restricted to a narrow V-shaped canyon. Alluvial sediments, primarily sand and gravel, have been deposited in the flood plain. At slightly higher elevations along the river canyon above the flood plain lie alluvial terraces or pediments, which are the erosional remnants of ancient river levels left high above the current river.

Finally, several massive slump features are evident along the western and northern edges of the lease area. These features are the result of mass movement of blocks of consolidated rock and unconsolidated soil. Although it is somewhat difficult to differentiate between slumps and old terraces, slumps occur primarily on moist, steep, generally north-facing slopes.

Structure

The structural geology of the lease areas appears to be quite simple. The sedimentary strata of the Mesaverde formation (the coal- bearing strata) are relatively flat-lying with a regional dip of 3.5 degrees to the north-northeast. Local dips of up to 6.25 degrees are found.

There are three sets of fracture systems found in the area, and they are reflected in the drainage system. The most prominent set trends northwest-southeast and northeast-southwest. The less pronounced system runs north-south and east-west and is seen only locally. The least prominent set is a joint system and is best expressed by the cleat system of the coal. Where exposed by mining in both the B and C seams, the cleat system trends south 75 degrees west.

Stratigraphy

The main coal beds on the lease area are found in the Upper Cretaceous Mesaverde formation which is overlain by the early Tertiary Ohio Creek conglomerate and underlain by the Upper Cretaceous Mancos shale. Locally the Mesaverde is about 2,500 feet thick and comprises (in ascending order) the Rollins sandstone member, the Bowie shale member, the Paonia shale member, and the barren member. Figure AR2-1 presents a stratigraphic column of the coal-bearing Mesaverde formation in the northern end of the area.

The Rollins member is a conspicuous white to buff, cliff-forming sandstone and ranges in thickness from 150 feet to over 200 feet. Although this sandstone forms a good regional subsurface marker for coal, it is a poor local marker because of lateral facies changes into shale. The Bowie shale member is composed of 50 to 180 feet of interbedded sandstone, shale, and coal overlain by an irregular sandstone bed 50 to 100 feet thick. The member contains the A, B, and C coal seams. The Bear Mine, which operates currently on the northern portion of the ARCO federal coal leases, produces from the C seam. The Paonia shale member consists of interbedded sandstone, shale, and coal similar to the lower coal member except the beds are more lenticular. This member ranges from 250 to 350 feet in thickness and is capped by a thick sandstone. The D, E, and F seams are found in this member. The Mt. Gunnison No. 1 Mine will mine completely in the F seam; see Mineral Resources for further discussion. Above the Paonia shale member there is a thick sandstone-shale sequence which does not contain coal. Figure AR2-2 shows the outcrop of the B, E, and F seams.

The F seam outcrops (although exposures are rare) on the northern side of the ARCO lease area along the North Fork of the Gunnison River and on the western side of the lease area along the

South Fork of Minnesota Creek. Limited exposures of the F seam are also found along the northern portions of Sylvester Gulch. The best exposures are along the west and south-facing escarpments from just north of Dry Fork to south of Lick Creek. The remainder of the outcrop shows significant vegetation cover. Burn areas are predominantly on south and west-facing slopes. Burn is not extensive nor continuous along the outcrop.

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be considered in the ES process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table AR2-1. Due to the present lack of data and accepted criteria for determining significance, the importance of these paleontological resources to science, education, etc., cannot presently be assessed.

The BLM and U.S. Geological Survey (USGS) are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

Mineral Resources

Coal

Within ARCO's proposed lease area, there are seven major coal seams that vary from 4 to 26 feet thick in the Mesaverde formation: the B, C, E, two E rider seams, F, and one F rider seam. Several other seams average about or less than 3 feet thick. The F seam overburden varies from about 500 feet to about 1,500 feet, averaging about 800 feet.

ARCO's mining and reclamation (M&R) plan details the mining of only the F seam, which ranges in thickness from 5 to 8 feet, averaging 7 feet. Average weighed quality of the F seam coal was given as 11,846 BTUs, 0.47 percent sulfur, 10.44 percent moisture, 4.53 percent ash, 48.62 percent fixed carbon, and 36.26 percent volatile matter.

Total in-place coal reserves for the leased federal land in the Mt. Gunnison No. 1 M&R plan were estimated by the USGS at 405.9 million tons. The company estimated that the F seam contains 118.7 million tons of coal reserves under 9,258 acres of both federal and private leases. Details of the coal reserves in the other coal seams were not given in the M&R plan.

Oil and Gas

The potential for the discovery of oil and gas under the leased area is very slight. Dry wells have been drilled a few miles to the southwest and to the northeast; these wells tested the Dakota sandstone.

Water Resources

Surface Water

The ARCO coal mine and processing facilities would be located within the North Fork drainage, a tributary to the Gunnison River. The North Fork subdrainage ranges in elevation from 5,500 to 12,000 feet and drains a total of 1,253 square miles, producing an average annual discharge of 469,300 acre-feet, or 648 cubic feet per second (cfs). (Department of Agriculture 1962) The average flow rate of the river at the location of the mine is 315,100 acre-feet, or 435 cfs (USGS 1974). Peak flows of the North Fork of the Gunnison River occur in May as a result of melting snowpacks. The North Fork of the Gunnison River generally flows in a westerly direction into the Gunnison River and subsequently into the Colorado River.

There are two subdrainages within the lease area, Sylvester Gulch and Minnesota Creek. The annual discharge rate of Sylvester Gulch is unknown. There are no discharge records on this stream, and there was no flow during late summer of 1977 when the stream was examined. Minnesota Creek has several perennial tributaries, two of which flow through the lease area, Dry Fork and East Fork. Minnesota Creek and its tributaries produce 16,900 acre-feet of water annually (1943 to 1960 average).

Dry Fork of Minnesota Creek, which drains the middle region of the lease area, has an annual flow rate that is supplemented by water diverted from Little Gunnison Creek, a tributary of Coal Creek, via Deep Creek Ditch. This diversion is used to fill an irrigation reservoir (Minnesota Reservoir) located on Dry Fork of Minnesota Creek, to be discussed later. Because of the introduction of foreign water in its upper regions and the impoundment of water at Minnesota Reservoir, Dry Fork's flow has been greatly altered from its natural state. Historically, pre-impoundment low flow values have been expected to be less than 1 cfs during late summer or early fall. Other flow data are unknown.

East Fork of Minnesota Creek and its tributaries drain the southern region of the lease area. The flow rates of this stream are also altered by an irrigation reservoir (Beaver Reservoir) and several,

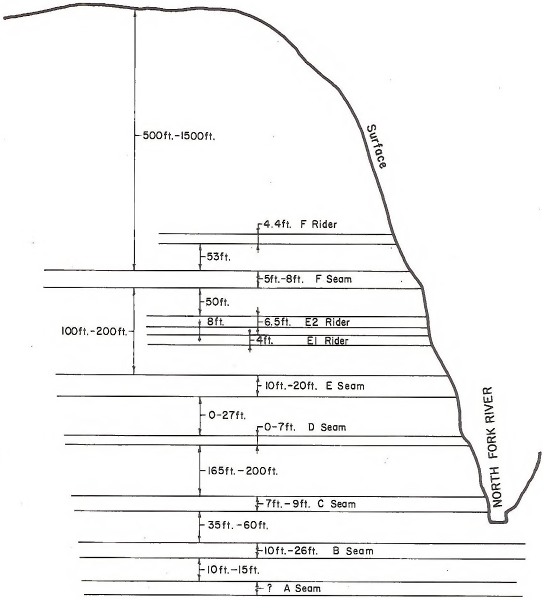


Figure AR2-1. Schematic of coal seams at the proposed Mt. Gunnison No. 1 Mine

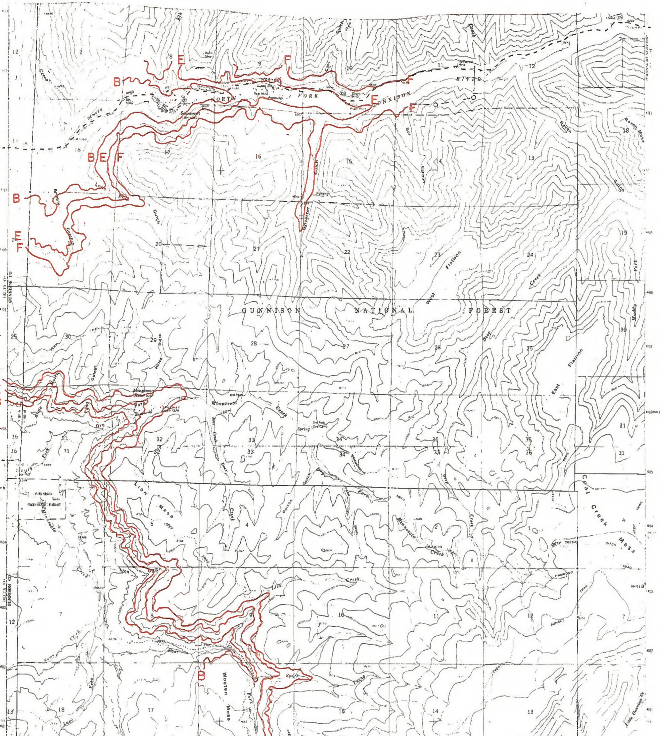


Figure AR2-2. Outcrop of the B, E, and F coal seams at the Mt. Gunnison No. 1 Mine

TABLE AR2-1

SUMMARY OF FOSSIL-BEARING FORMATIONS IN THE AREA OF THE PROPOSED ARCO MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils b/
Mancos	Late Cretaceous	General	V, I
Mesaverde	Late Cretaceous	General	V, I, P
Ohio Creek	Tertiary	General	V, I, P
Wasatch	Tertiary	General	V, I, P

a/ General: Formation contains fossils throughout; specific localities are not identified.

b/ V = vertebrate; I = invertebrate; P = paleobotanical.

very small, natural reservoirs at the headwaters of its tributaries. Because of uncontrolled tributary streams which enter the East Fork downstream from the reservoir, it still experiences a high water period in the spring. These flow rates are not published and are unknown.

The two irrigation reservoirs located within the lease area, Minnesota Reservoir and Beaver Reservoir, are owned by irrigation companies and are used to maintain irrigation flows. Minnesota Reservoir has a capacity of 1,285 acre-feet, and Beaver Reservoir has a capacity of 1,146 acre-feet. Beaver Reservoir has a higher design capacity, but because of leakage, the capacity has been restricted to the given value. The Colorado Division of Wildlife holds a 20-acre-foot conservation pool for fisheries habitat in Beaver Reservoir, which means that the usable capacity is 1,126 acre-feet.

Ground Water

The best general information on ground water conditions in this area is contained in Price and Arnow (1974). Ground water exists under both water table (unconfined) and artesian (confined) conditions. Ground water down to the Dakota sandstone is generally unconfined. Water wells in alluvium of the Quaternary period are expected to yield between 0 to 500 gallons per minute (gpm) in varying depths from a few feet to more than 100 feet. Water in these aquifers occurs in openings and voids between the various constituent particles. Porosity and permeability are commonly quite high but can be affected locally by poor sorting (clay material).

Ground water in the Mesaverde formation is considered to be controlled by interstitial porosity, meaning that water is contained and transmitted through interconnected pore spaces between grains within the sedimentary bedrock. Water yields of 0 to 50 gpm may be expected, with an average of 10 gpm.

Water Quality

A discussion of the water quality of the North Fork of the Gunnison River can be found in the regional analysis. In general, the North Fork is slightly alkaline with electrical conductivity increasing with stream length, primarily due to agricultural return flows. Nutrient levels (ammonia, nitrite, nitrate, and phosphate) are not excessively high. With the exception of occasional high iron levels, there is no evidence of a serious dissolved metals content. In fact, the Colorado Department of Health classifies the North Fork of the Gunnison River as a B 1 quality water system.

The water quality of East Fork of Minnesota Creek, Dry Fork of Minnesota Creek, Minnesota Reservoir, and Beaver Reservoir has been measured and analyzed for ARCO by Ecology Consultants, Incorporated, Fort Collins, Colorado. The water within both subdrainages was found to be slightly alkaline, soft to moderately hard calcium bicarbonate type in the upper portions of the streams and hard to very hard type waters at the lower stations. Dissolved solids concentrations range from 60 to 364 milligrams per liter in East Fork and 16 to 1,049 milligrams per liter in Dry Fork. Concentrations of trace elements were within the normal range for fresh water.

No data for Sylvester Gulch have been collected by federal, state, or private consultants. However, because this stream is spring fed, the water quality can be expected to be equivalent to that of spring water. It should be very high in dissolved calcium-sodium-bicarbonate solids.

The quality of the ground water is similar to that of the rest of the region. Generally, the quality of ground water in the Mesaverde group can be expected to be of poor quality. Analysis of water throughout this aquifer shows that excessive iron, manganese, sulfate, and fluoride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1973, Price and Arnow 1974, and Brogdon and Giles 1977). Typically the water is of poor chemical quality for domestic or public uses.

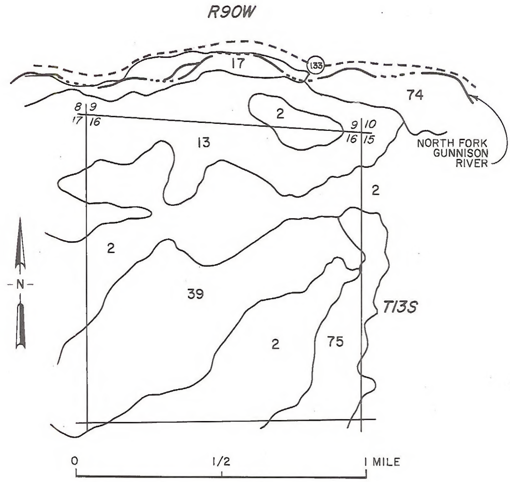
Soils

Soil units in the area of proposed surface disturbance are shown in figure AR2-3. Individual mapping units range from deep, relatively flat-lying alluvial deposits along the North Fork to shallow soils and rock outcrops on the steep side-slopes. Specific soil features of importance in assessing reclamation are rated in table AR2-2; the footnotes contain brief explanations of each rating.

Vegetation

The vegetation within the area of the proposed action consists of five vegetation types: mountain shrub, Douglas fir, aspen, sagebrush, juniper, and riparian. (See map AR2-1.) The mountain shrub type is the most widespread and is present in all parts of the coal lease area. It is replaced at higher elevations by aspen, and on north and northeast slopes by Douglas fir. Aspen occurs generally above 8,000 feet but may extend lower on northern slopes or along drainage bottoms. The sagebrush type is infrequent in the coal lease area; where present, it is on gentle slopes with well-developed, deep soil. A small area consisting of Utah juniper is present near the east fork of Minnesota Creek, on south and east-facing shale and sandstone outcroppings.

The riparian vegetation type occurs in drainage bottoms. At elevations below 6,500 feet, it is dominated by narrowleaf cottonwood and box elder.



MAPPING UNITS

2 Absarokee-Work loams, 6-25% slopes
13 Beenom-Absarokee Assoc., 20-60% slopes
17 Breece loam, 1-6% slopes
39 Fughes loam, 25-60% slopes
74 Torriorthents-Haplargids complex, very stony
75 Torriorthents-Rock outcrop, Sandstone, complex

Figure AR2-3. Soil units in the area of the proposed Mt. Gunnison No. 1 Mine

TABLE AR2-2

SOIL FEATURES FOR ARCO MINING AREA

Mapping Unit No.	Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
2	Absarokee-Work loams, 6-25% slopes				
	Absarokee part	C	Moderate	Fair	Moderate
	Work part	C	Moderate-High	Fair	Moderate
13	Beenom-Absarokee assoc., 20-60% slopes				
	Beenom part	D	High	Poor	Severe
	Absarokee part	C	High	Fair	Severe
17	Breece loam, 1-6% slopes	B	Low-Moderate	Good	Slight
39	Fughes loam, 25-65% slopes	C	High	Fair	Severe
74	Torriorthents-Haplargid complex, very stony				
	Torriorthents part	B	Low-Moderate	Poor	Moderate
	Haplargids part	B	Moderate	Poor	Moderate
75	Torriorthents-Rock outcrop, sandstone, complex				
	Torriorthents part	D	High	Poor	Severe
	Rock outcrop part	-	-	-	-

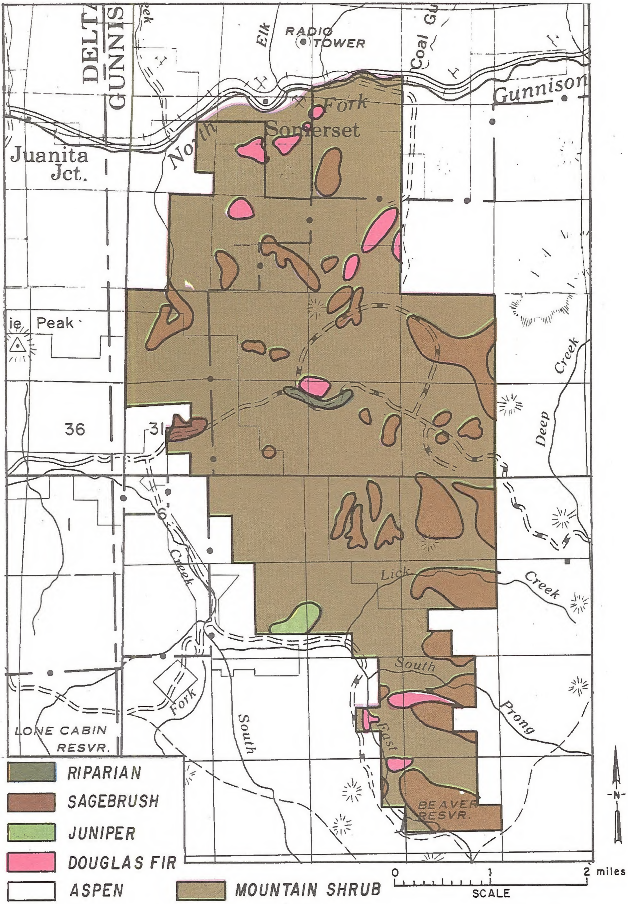
Note: Adapted from U.S. Dept. of Agriculture, Soil Conservation Service (Delta, Colorado), Paonia Area Soil Survey Report (Draft).

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic and soil conditions which produce extreme surface erosion or landslide hazards.



Map AR2-1. Vegetative types in the area of the proposed Mt. Gunnison No. 1 Mine

Above 6,500 feet, shrubby species of the mountain brush community--gambel oak, serviceberry, and hawthorn--compose the riparian type. Aspen may also be a riparian plant of drainages above 6,500 feet. No data are available on aquatic vegetation in the proposed mine area.

A more detailed discussion of the plant species composition of these vegetation types, as well as their relationship to climatic and topographic features and to each other, can be found in the regional analysis. Scientific names of the plants are listed in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the Federal Register (see table R2-10 in the regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State University, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/ Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Mt. Gunnison mine. The results of the literature and herbarium studies may be seen at the BLM Montrose District Office. A detailed floristic and endangered and threatened plant inventory of the natural vegetation that is expected to be disturbed by the Mt. Gunnison mine facilities and roads has revealed that no endangered or threatened plants are present. The results of this inventory are available for public review at the Montrose District Office.

Wildlife

All terrestrial species known or expected to occur on the tract are listed in appendix C. (Ecology Consultants 1977.)

Big Game

Mule Deer

The majority of ARCO's proposed lease area is classified as mule deer summer range; there is also a small crucial wintering area in the lower reaches of Minnesota Creek. (See map AR2-2.) The greatest number of deer occurs on the lease area during the fall and spring migrations. Colorado Division of Wildlife (DOW) transects in the wintering area (Porter Flats) indicate the following deer days per acre: 1973, 235; 1974, 35; 1975, 128; and 1976, 111; average, 99. The year of lightest use (1974) was such a severe winter that the deer were forced out of this area as well as the higher elevations.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average numbers. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer population within the ARCO lease area of about 150 animals during the winter months. Populations on the lease area appear to be on an increasing trend.

Mule deer use the mountain shrub, aspen, and spruce habitat types during the summer and primarily the mountain shrub type in the winter. The browse species in the wintering area are generally in very poor condition, especially on the south-facing slopes, which are most utilized by deer because of shallow snow depth in the winter and early melting in the spring.

Elk

Elk use the lease area primarily in winter, although there is a small summer range around Beaver Reservoir (map AR2-2). Normally, over 200 animals winter on the lease area. DOW transects for five years show an average of 3.6 elk days of use per acre. Fish Creek, Dry Fork of Minnesota Creek, and the ridge to the north are usually the major concentration areas. The habitat types utilized by elk include mountain shrub, aspen, and spruce-fir year-round. Prior to calving in July, the elk move off the lease tract to East Flatiron Mesa and the head of South Range Creek.

Elk populations appear to be on a generally increasing trend in recent years. Elk winter population estimates in the ARCO area indicate about 8 elk per square mile. This would result in about 1,606 elk inhabiting the site during an average winter.

Black Bear

Black bear generally utilize the mountain shrub, aspen, and spruce- fir habitat types, which provide the best food and cover. The greatest concentration of bear is south of the main ridge between Dry Fork Minnesota Creek and the North Fork of the Gunnison River (map AR2-2). The rocky slopes in the vicinity of Minnesota Reservoir contain numerous caves, which are used for winter hibernation.

Mountain Lion

Mountain lions are occasionally reported in the North Fork area. Although there have been no recent reports in the lease area, lions could occasionally use the area.

Small Mammals

The aquatic and riparian vegetation provides habitat for beaver and muskrat along the North Fork, Dry Fork of Minnesota Creek, and Fish Creek. Raccoon, striped skunk, and weasel are associated with the riparian habitat.

Cottontail rabbits are common in the drainage bottoms, utilizing sagebrush flats and pinyon-juniper hillsides. Snowshoe hares occur at higher elevations in the aspen, Douglas fir, and mountain shrub types.

Coyotes are common throughout the area; bobcat and badger are present but in fewer numbers. Ringtail cat, marten, and mink probably occur sporadically in the lease area.

Trapping studies conducted in a variety of habitat types found the following small mammals in order of abundance: deer mouse, long-tailed vole, golden mantled ground squirrel, least chipmunk, red-backed vole, rock squirrel, and western jumping mouse. The deer mouse was most abundant in mountain shrub habitat, while the golden mantled ground squirrel was most abundant in upland big meadow habitat.

Game Birds

The mourning dove is the most common game bird in the lease area. It is present only during the summer, generally at lower elevations. Blue grouse occur at higher elevations, using stream courses as brood rearing habitat.

Waterfowl are limited to the North Fork of the Gunnison River and the East and Dry forks of Minnesota Creek. Mallards would be the primary breeding species, while common mergansers and common goldeneye would be the major winter users of the Gunnison River.

Other Birds

During the breeding season, eight species of raptors are found in the area; nesting activity has been confirmed for five species. The red-tailed hawk and Cooper's hawk are the most abundant breeding species. One golden eagle nest has been located on the tract. During the winter, the red-tailed hawk and golden eagle have been most commonly observed, and bald eagles use the riparian community along the North Fork. (See map AR2-3.)

Over 50 species of songbirds have been observed on the tract. The aspen and riparian habitat types contain the greatest variety of bird life. Summer populations are greater than winter, with the robin and dark-eyed junco the most common winter residents, and the blue-gray gnatcatcher, yellow warbler, green-tailed towhee, and rufous-sided towhee the most abundant summer residents.

Amphibians and Reptiles

The number and abundance of amphibians and reptiles are relatively low on the lease tract. Few cold-blooded species can survive at the elevation and climate of the lease area. The sagebrush lizard and the eastern fence lizard are the most common reptiles. The gopher snake and the wandering garter snake are also expected to occur. The only amphibian that has been found is the chorus frog along Dry and East Minnesota creeks.

Endangered or Threatened Species

Bald eagles use the area primarily in the winter in the riparian vegetation along the North Fork. Although observations have been made of bald eagles during the time they should be nesting, no nest sites have been located. Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle.

Aquatic Biology

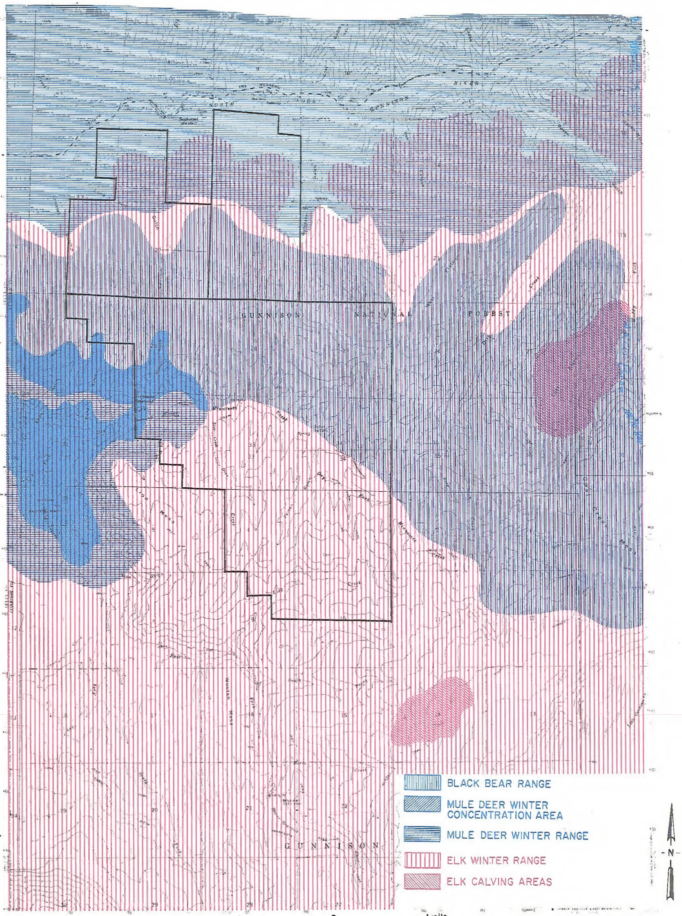
The ARCO site lies along the North Fork of the Gunnison River near Somerset. The tract boundary fronts on the south bank of the river for mile. The tributaries of Minnesota Creek--the Dry Fork; Lick, Hoodoo, Horse, and South Prong creeks; and the East Fork--are the major drainages of the tract. Two reservoirs, Minnesota and Beaver, are also in the lease area. All of these resources are discussed below.

North Fork of the Gunnison River

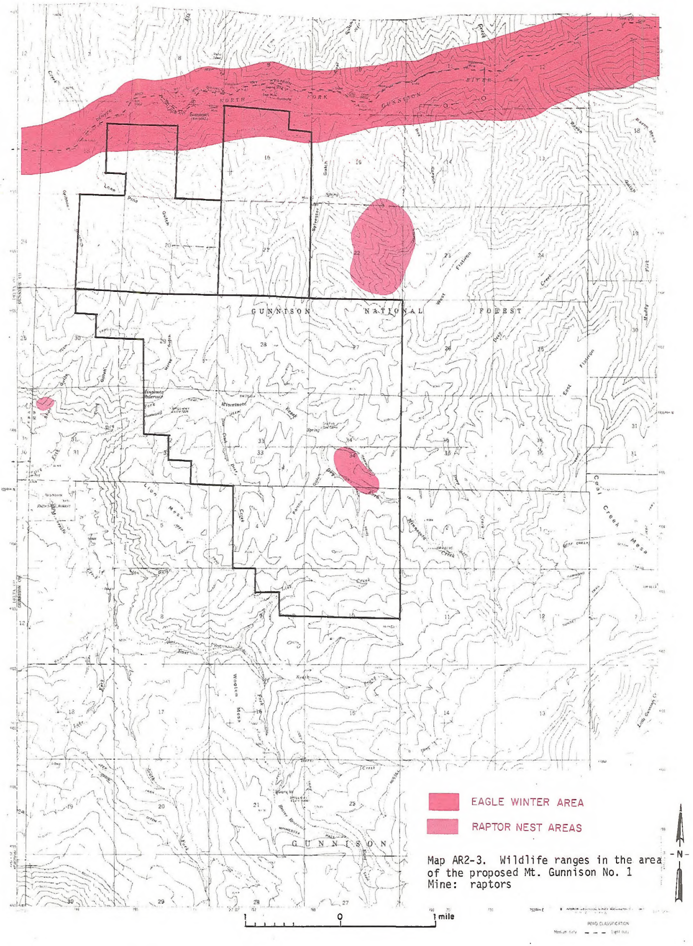
The North Fork of the Gunnison River begins at the confluence of Anthracite and Muddy creeks, approximately 4 miles upstream from the proposed lease area. The river flows from east to west along ARCO's northern property boundary through a deeply incised canyon. With the exception of 1.2 miles of stream which cross national forest land (NFL) and public land on or near the lease site, the North Fork channel is entirely privately owned.

Surveys assessing the condition of the aquatic environment as indicated by macroinvertebrate populations show that the section of stream above Paonia is in excellent condition. Both numbers and kinds of organisms indicate an unstressed environment. The stream below Paonia is stressed due to partial dewatering for irrigation and return of poor quality irrigation drainage water to the river.

Fish species in the North Fork vary with the location on the stream. From Paonia Reservoir downstream 5 miles to Somerset, the DOW stocks 2,000 catchable-sized rainbow trout annually. On down to Paonia, cutthroat, rainbow, and brown



Map AR2-2. Wildlife ranges in the area of the proposed Mt. Gunnison No. 1 Mine: deer, elk, bear



Map AR2-3. Wildlife ranges in the area of the proposed Mt. Gunnison No. 1 Mine: raptors

trout occur, along with suckers, sculpin, dace, and northern pike (originally planted by DOW in Paonia Reservoir). Below Paonia, the fish fauna shifts predominantly to suckers and minnows, with dace, sunfish, and northern pike occurring in reduced numbers. The North Fork supports an estimated 2,000 angler days annually in the Paonia Reservoir-to-Somerset section and approximately 500 angler days annually throughout the rest of the river. (See regional chapter 2, Aquatic Biology, for more information.)

Dry Fork of Minnesota Creek

The Dry Fork is the northernmost tributary of Minnesota Creek and drains the middle region of the lease area. An irrigation control reservoir, Minnesota Reservoir, is located on the Dry Fork. Because the Dry Fork is a small watershed, most of the water used to fill Minnesota Reservoir each spring is diverted from Little Gunnison Creek, via Deep Creek Ditch. Stream flows in the Dry Fork are greatly modified in terms of quality and time of discharge as a result of the diverted water.

There are 2 miles of stream channel below Minnesota Reservoir, 1 mile on private land and 1 mile on public lands. Due to the Dry Fork's extreme fluctuations in stream flow and its poor habitat, there are no resident fish populations nor does the DOW stock the stream. The limited invertebrate populations also reflect the poor quality of the environment.

Lick, Hoodoo, Horse, and South Prong Creeks

Lick, Hoodoo, Horse, and South Prong creeks are tributaries of the East Fork of Minnesota Creek which drain the southernmost region of the lease area. The creeks run through 3 miles of private land and 6 miles of NFL. They are high gradient streams with substrates composed of large rubble to boulder-sized sedimentary rock; as a result, their stream flows consist of a series of rapids and small falls. Pool habitat is limited to small pools on the downstream side of large boulders, and, in general, the pools are too small and shallow to support fish. Summer stream flows in these streams are near 1 cfs. The main fishery value of these steams is the quality of water they discharge into waters downstream. Invertebrate surveys done on Horse and South Prong creeks show that the aquatic environment in these streams is good and not unduly stressed.

East Fork of Minnesota Creek

The East Fork of Minnesota Creek is the major drainage from the tract. Four miles of the stream channel are on NFL, 0.5 mile is on public land, and the remaining 9.5 miles are on private land. However, 22 percent of the watershed is on public land. Beaver Reservoir, a small irrigation impoundment, is located on the East Fork just below Hoodoo Creek.

Stream elevations range from 9,400 feet at the headwaters of the East Fork to 6,042 feet at the confluence with the North Fork of the Gunnison River, giving an average gradient of 5 percent. Average spring discharge flows are 100 cfs; late summer and early falls flows, 5 cfs.

The fishery habitat of the East Fork is in generally good condition. Riparian growth provides good cover and shading; bank stability, pool quality, and substrate materials are excellent. Fish in the stream include minnows, suckers, and rainbow trout at lower elevations, sculpin, rainbow, cutthroat, and brook trout at middle and upper elevations. No fish are stocked in the stream by DOW; however, trout stocked in upstream irrigation reservoirs migrate downstream. Even though the stream has good roadside access throughout most of its length, angler use is light, with fewer than 500 angler days annually spent on the stream.

Reservoirs

The 17-acre Minnesota Reservoir is located on the Dry Fork of Minnesota Creek. It has a maximum depth of 50 feet and a storage capacity of 1,285 acre-feet; the lake has no fish.

The 80-acre Beaver Reservoir is located on the East Fork of Minnesota Creek. At design storage capacity (1,620 acre-feet), Beaver Reservoir would have a maximum depth of 86 feet; however, because of leakage, the maximum depth is restricted to 75 feet. Its maximum storage capacity is 1,146 acre-feet. To supplement the natural population of brook trout, the DOW stocks 3,200 rainbow trout fingerlings annually in Beaver Reservoir.

Both reservoirs are owned by irrigation companies. Because they are irrigation reservoirs, they have extreme seasonal fluctuations. They are at maximum level in late spring and early summer, are drawn down during late summer, and remain at a low level until the following spring. During the fall, winter, and spring, the surface area of each reservoir is often less than 3 acres. The DOW holds a 20 acre-foot conservation pool in Beaver Reservoir, but Minnesota Reservoir is occasionally drawn down nearly dry.

Endangered or Threatened Species

There are no threatened or endangered aquatic species in the proposed ARCO mine area watersheds.

Cultural Resources

Archeological Resources

An archeological inventory was completed on all areas that would be impacted as a result of surface disturbing activities (Applegarth 1977). No archeo-

logical values were located. The lack of identified archeological values and the environmental constraints of the area indicate low site density for the Mt. Gunnison Mine area (Applegarth 1977).

Historical Resources

Areas of disturbance at the Mt. Gunnison Mine have been inventoried, and two historic homesteads have been located (Applegarth 1977). Neither site is considered eligible for the National Register of Historic Places; the State Historic Preservation Officer has concurred in this finding.

Transportation

Highways

The proposed ARCO mine site is located in the North Fork valley near the town of Somerset. The nearest highway is State Highway 133, which is on the opposite side of the North Fork River from the proposed facilities. Plans have been made to improve this road in the vicinity of the Mount Gunnison property. In 1976 average daily traffic was 900 vehicles west of Somerset and 550 east of Somerset.

Railroads

The branch line of the Denver and Rio Grande Western Railroad (D&RGW) is parallel to State Highway 133 in the portion of the North Fork Canyon near the proposed mine. This railroad serves the other mines in the area. Presently seven coal trains per week go out of the North Fork. This branch connects with the D&RGW mainline near Grand Junction. Centralized traffic control would upgrade this line to mainline capacity.

Airports

Montrose is the closest airport to the proposed mine with regularly scheduled airline service. Frontier Airlines provides flights to Denver and Grand Junction. The Grand Junction airport is also near and is served by Frontier and United Airlines. Smaller airports are located at Delta and Hotchkiss.

Livestock

The national forest systems land within the ARCO coal lease tract is part of the Dry Fork grazing allotment. Cattle are grazed on this allotment between June 16 and October 15 of each year.

Small parcels of public land within the coal lease tract are part of the Jumbo Mountain BLM grazing allotment. Cattle are grazed on this allotment from May 11 until June 15, when they are turned onto NFL.

The grazing privileges on ARCO's private surface are leased to Harold Ross and Neal Rinehart. They graze cattle on the land between June 16 and November 1.

The total animal unit months (AUMs) of grazing on the public, national forest, and private land are 1,793 AUMs for 12,578 acres. This is equivalent to 7 acres per AUM of grazing.

Recreation

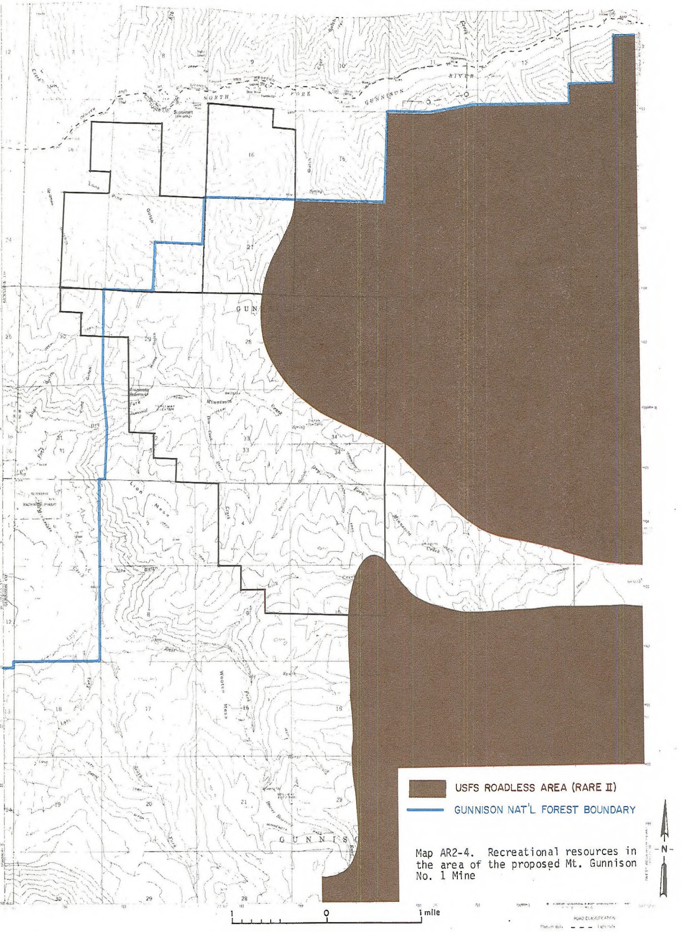
Approximately 5,600 acres of the lease site are in the Gunnison National Forest. Approximately 1,200 acres of this area, on the eastern edge of the lease, are being considered for inclusion into the U.S. Forest Service wilderness system. (See map AR2-4.)

There are no recreational facilities on the lease site. However, the site provides opportunities for dispersed activities, such as hiking, camping, hunting, fishing, and snowmobiling. The lease site is located within Big Game Management Unit 53, which provided 16,748 hunter days in 1976; table AR2-3 lists hunter days and numbers as well as species hunted. The lease site is also within Small Game Management Unit 66; table AR2-4 lists hunter days, etc.; however, because of the large size of the unit, figures may not indicate specific use on the lease site. (Refer to Wildlife in this chapter for the extent of the resource.)

The North Fork of the Gunnison provides a trout fishery, with populations of rainbows, cutthroats, and browns. The DOW stocks rainbow trout in Beaver Reservoir, and the East Fork of the Minnesota Creek derives a small fisheries potential from the stocked fish. (Refer to Aquatic Biology in this chapter for the extent of the resource.) The North Fork of the Gunnison has potential for river floating during the spring high water period, but during most of the year the water level is too low for such use (Colorado Division of Parks and Outdoor Recreation, 'Recreational Boating on Colorado Streams').

The Paonia State Recreation Area, located 8 miles east of the lease site, is operated by the Colorado Division of Parks and Outdoor Recreation. The main access to the area is along the north edge of the lease. The area provides a boat launch, picnic tables, camping sites, and vault- type toilets. The Paonia State Recreation Area had 15,225 visitors from July 1976 to June 1977 (Colorado Division of Parks and Outdoor Recreation 1977).

The nearby city of Paonia operates a park with a children's playground, a picnic area, and a basketball court. The school system maintains a softball field, a football field, and two tennis courts. The city of Somerset is fixing up a building and yard for a community center and playground. Visitor use information for the Paonia-Somerset community facilities is not available.



Map AR2-4. Recreational resources in the area of the proposed Mt. Gunnison No. 1 Mine

TABLE AR2-3

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 53

	Deer	Elk	Bear	Mountain Lion	Totals
Hunters	1,926	1,501	190	-	a/
Recreation days b/	7,801	7,422	1,525	-	16,748

Source: Colorado Division of Wildlife, 1976 Big Game Harvest.

a/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

b/ All or part of a day.

TABLE AR2-4

SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 66

Animal	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	249	977	Badgers	2	2
Doves and pigeons	366	1,093	Beavers	12	747
Pheasants	102	603	Bobcats	14	648
Grouse	830	1,890	Coyotes	25	886
Ptarmigans	131	349	Foxes	7	112
Rabbits	1,187	3,622	Martens	2	2
Squirrels	131	622	Muskrats	30	1,114
Coyotes	487	3,671	Raccoons	9	180
Marmots	346	649	Skunks	5	146
Porcupines	198	1,450			
Prairie dogs	267	1,527			
Magpies	213	1,501			
Crows	169	1,591			
Total	b/	19,585		b/	3,837

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

For a comprehensive look at the recreational resources of the region, refer to regional analysis, chapter 2, Recreation.

Visual Resources

The existing landscape character of the North Fork Valley is an approximate balance of natural scenery and cultural (coal) modification. The landform shape is a narrow river valley with sloping, partially terraced side slopes and steep escarpments. River benches and old alluvial formations make up the flatter areas adjacent to the North Fork River. Rock outcrops with horizontal stratification punctuate the vegetative cover at various elevations, displaying a dark tan color in the landscape. The vegetative cover is mixed, with riparian communities (cottonwoods near the river), mountain shrubs, and pinyon-juniper on the lower slopes and some aspen and Douglas fir stands on the higher slopes. The seasonal color change of the primarily deciduous vegetative cover is most vibrant in the fall.

The landscape character of the project area is a heavily modified mountain landscape. At this stage of development, the natural and modified environments are in a rough balance. Although the houses, mine sites, and other structures (see figure AR2-4) are a major landscape ingredient within the narrow valley environment, they do not as yet dominate the landscape because (1) the building sizes are relatively small and in scale with the landscape and (2) there has not been the major landscape alteration associated with large scale operations, with cut-and-fill terracing. In addition, not all of the mines and equipment are visible from any one point on Highway 133, so that natural and modified vistas are intermingled. Nevertheless, the coal emphasis is beginning to dominate the landscape as new structures (loadout facilities, parking areas, storage silos, preparation plants, conveyors, etc.) are built. Moreover, the mines do attract visual scrutiny because they contrast with the local mountain landscapes and because the conveyors, mine portals, etc., can be fascinating to a public that is unfamiliar with mining operations.

The combination of mountain scenery, water presence, and foreground viewing zone has placed the eastern end of the North Fork Valley in a visual resource management (VRM) Class II, but the landscape that surrounds the Bear Mine complex has been isolated as a VRM Class V. This designation indicates the need for site reclamation prior to achieving Class II potential.

Socioeconomic Conditions

Demography

The ARCO mine site is located within Gunnison County about 1 mile east of the small, unincorporated area of Somerset. The steep terrain of this eastern portion of the North Fork River Valley has limited its development as a residential area. Somerset was originally established as a company town to serve what is now the U.S. Steel Somerset Mine. Now the 63 residences which constitute Somerset are individually owned. Because almost all the land at Somerset which could be built upon is already occupied, the population has remained relatively stable for some time.

All other populated areas within the vicinity of the ARCO site are in Delta County. Table AR2-5 lists the population for each incorporated town and each county census area within Delta County, for the 1970 and 1977 censuses. The table indicates that Cedaredge and Orchard City experienced the most rapid rate of population growth in the county over the past seven years, although many parts of the county grew rapidly. The table also shows that the median age of the population is falling throughout the county, indicating an inmigration of predominantly young people. However, older, retired residents are still a significant portion of the county population. While those 65 years or older are only about 8.5 percent of the total state population, they constitute 20 to 30 percent of the total population in most areas of Delta County.

It should be noted that the smaller towns and rural areas of the county have grown the fastest. This supports the notion that many persons are migrating to Delta County to live in a rural setting. That trend is also indicated by the number of large lot housing sites which have been developed throughout the county.

Community Attitudes and Lifestyle

The lifestyles in Delta County are of the American rural-village/ open-country type. Low per capita incomes and remoteness from urban areas preclude elaborate lifestyles. Day-to-day life revolves around the family, jobs or farms, schools, school activities, civic organizations, and churches and church auxiliary activities. Recreational activities consist mainly of hunting, fishing, snowmobiling, skiing, attending high school sports events, T.V. viewing, driving cars or pickups for pleasure, and attending movies.

The rural, western attitudes of independence and self-reliance are prominent among county residents. Norms of neighborly cooperation and respect for neighbors' rights also exist. Cooperation is most conspicuous during times of crisis, e.g., family or natural disasters. In addition, the county residents

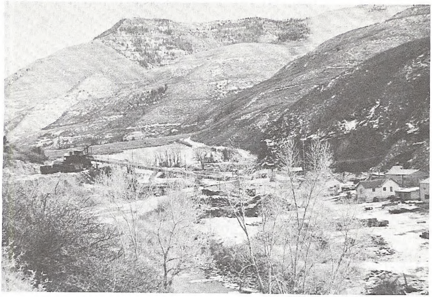


Figure AR2-4. Atlantic Richfield's proposed Mt. Gunnison Mine would be located on the slopes behind the existing Bear Mine.

TABLE AR2-5

POPULATION STATISTICS

	Total Population 1970	Total Population 1977	Percent Change 1970-1977	Median Age 1970	Median Age 1977	Percent of Population Over 65 Years Old 1977
Delta County	15,286	18,949	24	39.6	35.2	18
Cedaredge	581	966	66	--	55.7	33
Cedaredge Area	2,992	4,347	45	45.6	43.5	23
Crawford	171	261	53	--	41.9	26
Delta	3,694	3,705	0	43.4	35.6	22
Delta Area	7,201	8,290	15	36.1	32.3	17
Hotchkiss	507	728	43	--	39.0	26
Hotchkiss Area	2,684	3,499	30	40.6	34.6	17
Orchard City	1,163	1,815	56	48.4	44.1	25
Paonia	1,161	1,276	10	47.1	37.1	22
Paonia Area	2,409	2,813	17	41.0	33.6	15
Somerset Area	264			48.5		15*

*1970 figure

have a great respect for the natural beauty, fertility, and remoteness of their valley.

Results of the Delta County Opinion Survey conducted in 1974 are discussed in the socioeconomic section of the regional volume.

Community Facilities

The unincorporated areas of Delta County have absorbed much of recent growth. Many of these receive water from small independent water companies and have individual septic systems. The three landfills in Delta County are privately operated.

The present water facilities in Delta are being upgraded to improve service. Project 7 will greatly increase the supply of treated water to Delta. Improvement of the cities sewage treatment system is under study. The city operates its own electrical generating facility.

The town of Cedaredge is presently upgrading water facilities to serve an additional 2,800 people. The sewage treatment system is presently adequate for 2,800 prople.

Hotchkiss is presently upgrading water facilities in the town to serve 3,000 persons. The present sewage treatment system is adequate for a population of 750.

In Paonia peak water demand exceeds the supply of treated water. Improvements are under way to supply enough water for 2,900 additional people. Studies of the sewage treatment system are in progress. The town operates a volunteer fire department.

Community facilities in Delta County are discussed further in the regional volume. Figures AR2-5 and AR2-6 show the business districts of Delta and Paonia.

Housing

The Colorado Division of Housing estimates that there was a total of 6,610 housing units in Delta County in April 1976. The housing stock increased between 1970 and 1976 by about 12 percent or 735 additional units. (See table R2-34, regional volume.) Almost two-thirds of the increase in total housing units were mobile homes. Rental units constitute about 22 percent of the available housing units in Delta County. Local real estate people estimate that up to 200, or 3.5 percent, of the conventional houses are for sale. The 1977 special census listed 698 housing units as unoccupied; many of these, however, are in a deteriorated condition and unfit for habitation. Most communities in Delta County have limited area for new housing development within their existing boundaries.

In Paonia, Pan American Properties holds 83 acres, which they plan to develop in four phases, for a total of 240 new units. Presently, about two dozen homes have been completed or are under construction within the subdivision. Single family homes range in price from $35,000 to $38,000. The company plans to include some townhouse units, which will have a base price of $26,000.

In addition to this major subdivision, a number of other developments are in progress in and around Paonia. The Bonine Construction Company is building about 11 units on their property northwest of town. These units are designed as low-to-moderate-income units, priced between $25,000 and $30,000. Site development work has been almost completed on a 22-unit mobile home park north of town. There will be 19 homes available in the Fire Mountain Estates subdivision, now under construction on Pitkin Mesa. There are also plans for the construction of 24 single-family homes on the Bond property, south of town.

ARCO has purchased the Mott Ranch, south of the town of Paonia and outside the corporate limits. The purchase includes water rights, which were transferred to the town of Paonia in return for the provision of 400 water taps as they are required for the development of the property. According to company representatives, housing development of the Mott Ranch will proceed only after other housing in the area has been exhausted.

Paonia, according to the city manager, does not have much vacant land within its boundaries which is suitable for new subdivisions. However, infilling of existing lots could provide for some expansion of the housing supply. Paonia does not have a zoning ordinance.

Hotchkiss has recently annexed the Willow Heights Subdivision, which has 55 lots available in its second phase of development. Homes within this subdivision range in price from $26,000 to $50,000.

Housing in the town of Cedaredge has been expanding at the rate of three to five new homes per month over the past few years. Cedaredge is different from most towns in Delta County in that it has available land within town for substantial new housing development. Some 300 to 400 lots are now for sale. The Applewood Subdivision, with 74 mobile home sites, is under construction.

In the city of Delta, there is significant housing development southeast of town on Garnet Mesa, where approximately 100 new houses are planned in two subdivisions over the next few years. Delta has also approved the Bonine Annexation; once subdivided, it will add about 160 homes in Delta.

The county is trying to restrict the development of county areas to large-lot subdivisions. The need for adequate water and sewer service should place more restrictions on the development of rural lands than there has been in the past.

Figure AR2-5. Business district of Delta, Colorado.

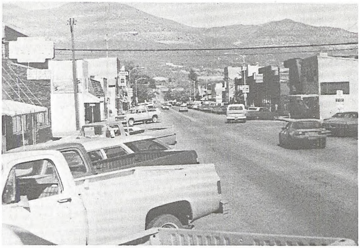


Figure AR2-6. Business district of Paonia, Colorado.

Education

Public education is important within the individual communities. Each town takes pride in its own high school and the extracurricular activities offered there. The district-wide dropout rate is 6 percent, much lower than the national average of 25 percent. Many county residents are also taking advantage of the courses offered by the recently opened Delta-Montrose Area Vocational-Technical School.

Delta County School District 50(J) includes all of Delta County and small portions of Montrose and Gunnison counties, including the Somerset area. In spite of the expressed pride in the schools by area residents, District 50(J) does not have adequate facilities for the current enrollment. Many of the schools are over 50 years old and are overcrowed (see table AR2-6). The district has proposed the consolidation of some of the schools in the four communities into fewer sites, but the idea was defeated on a referendum vote. An 8 million dollar bond issue for capital facilities construction was also defeated by a nearly two to one margin in the spring of 1976. The district is now employing a study group from the University of Northern Colorado to prepare a capital facilities improvement plan.

The district's mill levy (38.84 mills) is presently in the lowest 10 percent of school district mill levies statewide. The district has a bonding capacity of over $9 million, while outstanding debt is $61,000. The district's per pupil expenditure level is also low, compared to other school districts in the study area. The poor success of the district in generating more revenue locally is due to the refusal of voters, many of whom have low and/or fixed incomes, to authorize any increase in taxes.

Many of the facilities in the Paonia schools are inadequate to provide satisfactory education for the students. The elementary school consists of a metal building and three mobile home units that were erected in 1947. In the elementary school, the corridors are used for small groups; there are no central library, audio-visual, or media centers, or any indoor physical education facilities. In the junior high and high schools in Paonia, science facilities are less than minimum for adequate teaching, no art classes are offered, physical education facilities (including shower and storage facilities) are inadequate or nonexistent, media and library facilities are limited. The cafeteria and outdoor facilities are used by all schools. Mobile home units relieve some of the overcrowding pressures on classroom facilities.

The schools in Hotchkiss are generally less crowded than those in Paonia. However, the elementary school has two grades at capacity and two over capacity, and one class meets all day in the corridor. In the junior/senior high school, the science area is inadequate, and the library facility is rudimentary. All grades from elementary through high school use the same cafeteria in the high school and the same outside play area.

The Crawford School, for elementary grades only, was built in 1913 for 120 students and has an enrollment of 130. The first and second graders meet in one overcrowded classroom, and all other grades are at capacity. Due to the age of the building, many of the wooden frame windows will not open; some of the electrical wiring is quite old; and outside woodwork, cement steps, and sidewalks need repair. The cesspools overflow every spring.

Health Care

The Delta County Memorial Hospital District serves all of Delta County with a 32-bed hospital located just east of the city of Delta. The hospital is newly constructed, having opened its doors in December 1975. The current capital debt of the hospital district is $1.25 million, which is due to be retired in 1993. All county residents are assessed a 2.30 mill property tax levy for the purpose of retiring the debt on the hospital.

The hospital is supported by a staff of ten general practioners, all located in Delta County, and ten other doctors who offer part-time specialized services at the hospital. These part-time specialists reside primarily in Grand Junction or Montrose. The hospital also has a staff of sixteen full-time and eight part-time registered nurses (RNs), plus two RNs for surgery and one RN who works as an operating room technician. The hospital needs more family practice physicians. The hospital has an informal arrangement with hospitals in Grand Junction and Montrose to handle cases which it cannot accommodate.

The average daily occupancy rate of the hospital has steadily increased since it opened. The hospital administration estimates that the occupancy rate will average 75 percent of capacity during 1977. Plans are being made to add fifteen beds to the hospital by the end of 1979.

Two doctors attached to the hospital reside in the Cedaredge area, and two other doctors operate the North Fork Clinic, with an office in Hotchkiss and one in Paonia. In addition, the county employs two public health nurses, who provide health services to the public schools and patients in their homes.

Three ambulance services operate out of Delta, Cedaredge, and the North Fork, with two vehicles each. These services are staffed with volunteers, trained in emergency medical procedures.

Delta County has three nursing homes which have a total of 170 beds for long-term care.

Mental health needs are served by offices of the Midwestern Colorado Mental Health Center, which

TABLE AR2-6

DISTRICT 50(J) SCHOOL FACILITIES

School	Building Age (Years)	School Site	September 1976 Enrollment	Design Capacity	Excess Enrollment
Garnet Mesa Elementary in Delta	18	12 acres	650	550	100
Lincoln Elementary in Delta	70	1 block	292	290	2
Delta Junior High	12	17 acres site for Junior and Senior Highs	360	290	70
Delta Senior High	57		715	625	90
Cedaredge Elementary	18	--	202	220	--
Eckert Elementary	66	--	144	100	44
Cedaredge Junior and Senior High	57	20 acres site for Elementary-High School	371	281	90
Hotchkiss Elementary	18	--	240	300	--
Hotchkiss Junior and Senior High	54	15 acres site for Elementary-High School	300	300	--
Crawford Elementary	65	--	121	120	1
Paonia Elementary	30	--	233	200	33
Paonia Junior High	73	--	247	225	22
Paonia High	18	6 acres site for Elementary-High School	322	230	92

has a main office located in Montrose. They have an office in Delta and a part-time office in Paonia. They offer out-patient services for a range of mental health problems including specialized services for children and the elderly.

Employment

Major employers in Gunnison County are government, trade, services, and mining. Agriculture has declined in importance since 1970 while other sectors have grown.

In Delta County, where most of ARCO's employees would live, agriculture is the largest employer. Other important sectors are government, trade, and services.

More detailed information about employment in these counties is contained in the regional volume. Data are not available about employment in political subdivisions smaller than the county.

Income

The proposed Mt. Gunnison No. 1 Mine would be located just east of Somerset in Gunnison County, Colorado. There is no information available about incomes in Somerset; however, the area is economically dependent upon Delta County. Per capita income in Gunnison County was $3,483 in 1974, the lowest in the seven-county ES area, and $330 less than Delta County's $3,813. Per capita incomes of both counties are substantially below the state level of $5,514 and the national level of $5,449. In Delta County, median family income at $7,550 was the lowest in the region, and 19.4 percent of the families were living on incomes below the poverty level.

Gunnison County is very dependent upon government (30.3 percent) and mining (24.0 percent) as sources of personal income. Wholesale and retail trade (16.7 percent) and services (11.8 percent) are also important. Other sectors and their proportional shares are: contract construction, 4.4 percent; finance, insurance, and real estate, 4.4 percent; agriculture, 4.1 percent; transportation, communication, and public utilities, 2.3 percent; manufacturing, 2.0 percent; and other industries, 0.3 percent.

People in Delta County are very dependent upon agriculture and government as sources of income. Government at all levels supplies 23.2 percent of personal income and agriculture supplies 22.1 percent. Other important sectors are wholesale and retail trade with 17.2 percent, services with 11.6 percent, and manufacturing with 10.0 percent. Other sectors of less importance are contract construction, 5.7 percent; finance, insurance, and real estate, 4.6 percent; transportation, communication, and public utilities, 3.6 percent; mining, 2.1 percent; and other industries, 0.3 percent.

The regional economy and the relationship of Delta and Gunnison counties to other counties in the ES area are discussed in the regional volume.

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describle the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceding sections of chapter 2 which are expected to change in the future: mineral resources, archeological resources, livestock grazing, recreation, and socioeconomic conditions.

Mineral Resources

Without the proposed action, Bear Coal Company would continue to mine coal from lease D-044569 until the recoverable coal reserves are exhausted.

Archeological Resources

Through the year 1990, vandalism and erosion would be the two major factors causing the loss of archeological values. It is doubtful that additional monies or employees would be available to retard this loss, although the Federal Land Policy and Management Act of 1976 will provide BLM with more protective enforcement authority. The downward trend is expected to continue or accelerate under the present land use management program.

Livestock

The public land within the ARCO lease tract would be converted to a three-treatment rest-rotation grazing system of livestock production, seed trampling, and rest, as proposed in the Jumbo Mountain allotment management plan.

Recreation

The RARE II roadless area identified by the U.S. Forest Service (see map AR2-4) may be classified as wilderness, which would allow only nonmotorized travel and recreation in that area.

The city of Paonia and the historic Conservation Recreation Service are cooperating to develop a recreation site near the city. Construction of the four tennis courts, outdoor pool, and bathhouse on a 10-acre site is scheduled for 1978. This and present facilities would provide sufficient community recreation facilities for growth in Paonia without the ARCO development.

Population in Delta County would increase to 29,375 people in 1990, which would require an additional 34 acres of community active/improved park land (e.g., ballfields, playgrounds, tennis courts) to prevent overuse and deterioration of ex-

isting facilities (Bickert, Browne, Coddington, and Associates, Inc., 1976).

Socioeconomic Conditions

Delta County population is expected to continue to grow at a moderate rate to 29,375 people by 1990. This growth would primarily be due to increases in the number of retired persons moving to the area and to development of private coal holdings. Unemployment is expected to remain a serious problem. Although incomes are expected to increase, most likely they will remain substantially below state and national averages.

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review prior to promulgation of initial regulations 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), and it does not fully reflect the requirements of the initial regulations. However, in this environmental statement (ES) the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial regulations. The Department of the Interior will not approve the M&R plan until Atlantic Richfield Company (ARCO) has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Mt. Gunnison mine include conveyors, transfer points, coal preparation plant, train loadout of coal, employee access road, and wind erosion of the refuse pile. A common source of fugitive dust at underground mines not projected for the Mt. Gunnison mine is haul roads; trucks will not be used to transport the coal.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution- producing operation, (2) multiply that activity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Mt. Gunnison mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division (Colorado APCD 1978).

Table AR3-A presents estimates of fugitive dust emissions at the Mt. Gunnison site from each of the identified sources in 1985, 1990, and 2007 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The estimates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table AR3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Mt. Gunnison site other than fugitive dust sources were exhaust emissions from employees' motor vehicles on the mine access road. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table AR3-B. These emissions are based upon rates per mile of travel (emission factors) which will decrease between 1985 and subsequent study years. In the case of Mt. Gunnison, the reduced emission rates partially offset increased activity rates projected when the mine is at full production in 1990.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the canyon or valley near where mining emissions occur. The site specific meteorological data reflected the prevalence of transport of the pollutants up and down the canyon from the mine. Because of the greater influence of the canyon on maximum concentrations near the mine, a separate model which considers reflection of the plume was used to predict maximum 24-hour concentrations. This short-term model is described in the next section.

The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes. Emission data were previously presented in table AR3-A. The six months of wind data collected at the Mt. Gunnison site were insuffi cient for modeling purposes (see chapter 2). Therefore, wind and stability data required for the model were obtained from the Grand Junction airport, which also has a prevailing wind direction from the east-southeast and strong east-west channeling.

Predicted increases in ambient concentrations resulting from Mt. Gunnison's operation in 1990 are shown on map AR3-A; map AR3-B shows predicted cumulative concentration in the North Fork Valley. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 5 micrograms per cubic meter ($\mu g/m^3$) in only a small area on the mine site near the preparation plant; concentrations are predicted to increase by at least 1 $\mu g/m^3$ for a distance of 0.3 mile north and south and 0.8 mile east and west from the surface facilities. Predicted impacts in 1985 are slightly lower but are shown to occur in these same areas. Based on these concentrations, it is not anticipated that the emissions would cause significant increases in annual average concentrations outside the North Fork Valley.

The predicted impact of the mine is much less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. It is also much less than the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD), although coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

The dispersion model used to predict maximum 24-hour particulate concentrations assumed Gaussian distribution of particulates away from the plume centerline, a constant wind direction, and complete reflection of the plume off both canyon walls. The basic dispersion equation is described in detail in *Workbook of Atmospheric Dispersion Estimates* (Turner 1970).

Several locations (receptors) up and down North Fork Valley from the mine were specified in the model for prediction of ground-level concentrations. At each receptor, the contribution caused by each emission source at Mt. Gunnison was calculated separately; individual source contributions were summed to determine the total concentration at the receptor resulting from the mining operations.

Wind data taken at the mine site reveals that winds rarely blow up or down the valley for the entire 24 hours, but have a pronounced diurnal (daily) shift. The winds blew from a single quadrant only one day out of the six months of sampling. A 24-hour period with constant wind direction was assumed to produce the highest concentrations since downwind receptors would be in the plume almost continuously. Stable atmospheric conditions and moderate wind speeds (9 miles per hour during the day and 6.7 miles per hour at night) were also assumed for simulating maximum 24-hour concentrations.

The annual average emission rates from table AR3-A were also used to predict maximum concentrations because no information was available on seasonal variations in production. Although it is expected that emission rates will vary somewhat throughout the year, the sources at Mt. Gunnison mine are not subject to great increases in emissions due to equipment malfunction or high wind speeds. Also, increased emissions at different sources would occur independently rather than simultaneously and would probably not occur at the same time as the most adverse meteorological conditions.

Predicted maximum concentrations from the mine in 1990 are shown in map AR3-C. With winds from the west, a concentration of 19 $\mu g/m^3$ is projected to occur about 0.2 mile up the canyon, near the eastern property line. Higher con-

centrations predicted at even closer distances are an artifact of simplifications made in the modeling exercise. At 1.3 miles downwind, maximum concentrations are predicted to be 1 $\mu g/m^3$. With winds from the east the maximum concentration is predicted to be 14 $\mu g/m^3$ (at 0.2 mile). These concentrations are considerably less than the 24-hour primary air quality standard of 260 $\mu g/m^3$ and the secondary standard of 150 $\mu g/m^3$, and they are projected to occur only in the immediate vicinity of the mine. Maximum concentrations in 1985 would be 16 $\mu g/m^3$.

Because the short-term dispersion model involves prediction of extreme conditions for meteorology and emission rates, it is probably less accurate than the annual model.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine will reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west-central Colorado has been empirically determined by Ettinger and Royer (1972); it is shown in figure AR3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due to precipitation. Therefore, the equation is more likely to predict visual range over an averaging period of a year than for a short-term period such as 24 hours.

As indicated in map AR3-A, particulate concentrations in 1990 would be increased to a distance of 0.8 mile up or down the valley from the surface facilities. Along a line of sight up or down the valley from the mine buildings, concentrations would be increased an average of about 3.5 $\mu g/m^3$ over this limited distance. Using the equation above and a background particulate concentration of 28 ug/m^3, the estimated reduction in visual range on the mine site as a result of mining emissions would be about 4 miles on an annual basis. Because of the limited area of air quality impact, average visibility would not be affected significantly outside this 1.6 mile reach of the valley. Visibility reductions in 1985 would be even less than in 1990.

Geologic and Geographic Setting

Topography

Impacts of the proposed mining operation on the topography of the mine property would be minimal. The three major sources of topographic impacts would be excavation and earthmoving during construction of surface facilities; long-term use of the refuse disposal area; and surface subsidence due to subsurface withdrawal of coal reserves.

Excavation and earthmoving during site preparation for construction of surface facilities (including the refuse disposal area) would alter the natural topography of 77 acres by 1980, 91 acres by 1985, and 106 acres by 1990. These acreages represent 0.6 percent, 0.9 percent, and 1 percent respectively of the total project acres. The major impact would occur along the northern portion of the lease area where slopes are steep and north-facing; relief may approach 1,000 feet. Benching, grading, and leveling would be required. In addition, some areas may require blasting and cliff sealing. Level surfaces and cut-and-fill structures would replace the steep natural slopes for the 27-year mine life. The modified surfaces created would alter the drainage characteristics of the area, and both erosion and runoff would probably increase (see Water Resources and Soils). In addition, noise and vibration would add to the landslide and rockslide potential of the area.

Long-term use of the refuse area would gradually alter the surface topography of 35 acres by 1985 and 50 acres by 1990. This represents 0.3 percent and 0.4 percent, respectively, of the total project acres (however, this acreage was included in the acreage disturbed by earth work, as discussed above). Currently, the relief over the area is 175 feet, and the average slope is 10 percent. Use of the refuse disposal area for the 27-year mine life would produce a small area of steepened (approaching 27 degrees) north-facing slopes and a larger area of gentle backslopes (less than 5 degrees). The maximum increase in surface elevation would be 150 feet, which would occur along the northern edge of the refuse disposal area.

A more significant impact of the proposed mining operation would be surface subsidence. Surface subsidence could occur in areas both directly over and immediately adjacent to coal reserves which have been mined out or burned out. It should be noted that to some unknown extent land adjacent to the mine property would also be vulnerable to surface subsidence although the probability of actual damage is small. Therefore, a total of 9,528 acres (76 percent) of the mine property could be subject to surface subsidence.

Using the *Mining Engineer's Handbook*, the company has predicted a maximum of 3.5 feet of subsidence. This maximum subsidence is predicted to

TABLE AR3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED MT. GUNNISON MINE SITE

Emission source	Emissions, ton/yr	
	1985	1990 & EML
Conveyor - 4 sections	43.6	49.9
Transfer points - 1 point	1.6	1.8
Preparation plant	1.3	1.4
Train loadout	0.3	0.4
Access roads	0.8	1.5
Exposed areas - refuse - mine facilities (paved)	6.0 neg	8.6 neg
TOTAL	53.6	63.6

TABLE AR3-B

EMISSIONS OF GASEOUS POLLUTANTS FROM THE PROPOSED MT. GUNNISON MINE SITE

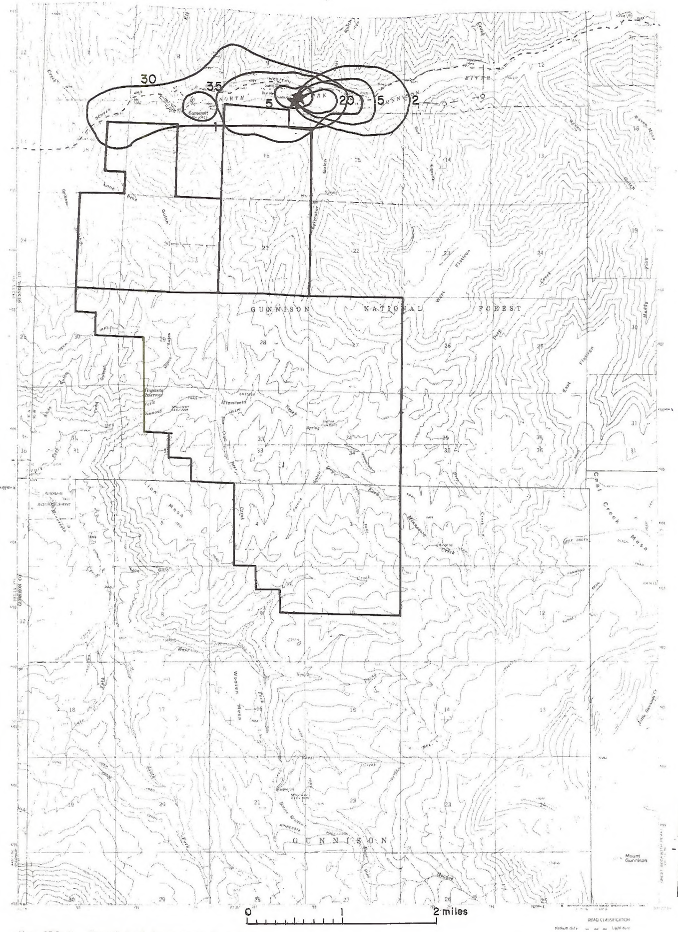
Year	Total emissions from vehicles, ton/yr			
	CO	HC	NO_x	SO_x
1985	2.0	0.2	0.3	neg
1990	2.1	0.2	0.6	neg

$$L_v = \frac{24}{0.2 + 0.007\,M}, \text{ where}$$

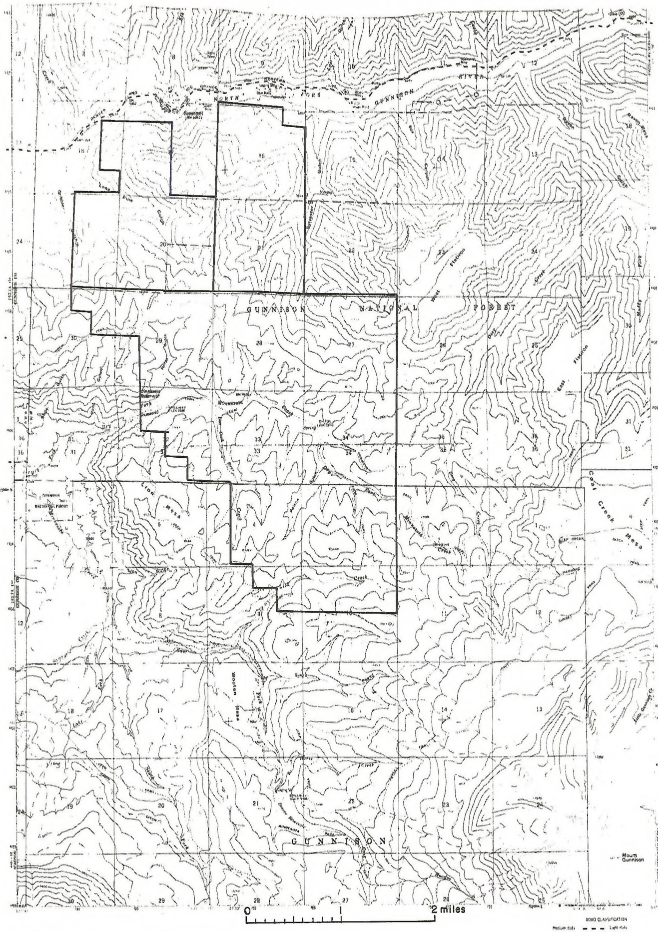
L_v = Average visual range, miles

M = Average particulate concentration (micrograms per cubic meter)

Figure AR3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).



Map AR3-A. Predicted increases in ambient concentrations in 1990 (micrograms per cubic meter)



Map AR3-B. Cumulative concentrations from proposed actions in the North Fork Valley (micrograms per cubic meter)

Surface Facilities

Map AR3-C. Predicted maximum 24-hour concentrations in 1990 (micrograms per cubic meter)

occur over the center of the longwall panels shown on the mining layout in map AR1-2. Subsidence would decrease proportionately as the distance from the center of the longwall panel increases. It is probable that no major fractures of the ground surfaces would occur. Because of the depth of mining (500 to 1,500 feet), a smooth subsidence trough would probably be superimposed on the existing topography. Little tilting or rotation of the surface would be expected, and surface strains would be expected to be small. The subsidence, however, may change the drainage characteristics of the area: small changes in the water table and water courses may occur.

In addition, subsidence induced by mining could increase air circulation at depth through fracturing, allowing spontaneous combustion of the coal beds. Burning of coal beds is thought to have occurred naturally under as much as 2,000 feet of overburden in the Terror Creek area of nearby Delta County, Colorado (Louis Gaspar, mining engineer, Coors Beer Company, 1977, oral communication). In addition to causing a loss of the coal resource, burning of the coal bed reduces the volume of coal and therefore may induce more subsidence above the seam. (See Mineral Resources, Water Resources, and Soils for further discussion of subsidence.)

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above impacts, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to the present lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the Bureau of Land Management (BLM)-U.S. Geological Survey (USGS) memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

Coal

The mining of 59.35 million tons of recoverable coal reserves over an estimated 27-year mine-life would result in the depletion of a nonrenewable energy resource. The coal is expected to be transported out of the area to utility plants for the production of electrical energy.

Subsidence resulting from mining the F seam would affect the F rider seam in the areas where the seam is economical to mine. Either the rider seam would have to be mined before development in the F seam is started, or the two seams could be mined simultaneously by carrying the mining of the rider seam in advance of mining in the F seam. Subsidence over the F seam would have no effect on the two E seam riders because they are 50 and 65 feet, respectively, below the F seam.

The longwall method of mining would result in the recovery of 80 to 100 percent of the longwall panels with an overall reserve recovery of 50 to 60 percent of the F seam. This is the most efficient method of mining the leased coal.

Oil and Gas

If oil and gas are discovered under the leased land, a settlement must be reached between the well owners and the owners of the coal leases as to which nonrenewable energy source would be produced first.

Water Resources

Surface Water

The consumption of surface water from the North Fork of the Gunnison River would reduce the river's annual discharge. The company has conditional water rights from the state of Colorado for 15 cubic feet per second (cfs), or 10,859.5 acre-feet per year, from the river; however, they would only require approximately 1.94 cfs, or 960 acre-feet per year, at the full production rate. In addition, mine water that is produced within the mine could be used, reducing the amount of water required from the North Fork. Mine water could make up as much as 15 to 20 percent of the total required water supply. The total reduction in the annual flow of the North Fork of the Gunnison would range from 0.79 cfs to 1 cfs (570 to 721 acre-feet), depending upon the quantity of ground water encountered. At this time, ARCO has no well permit or water rights to use any ground water obtained from the mining operation.

A serious impact to the Minnesota Creek drainages (East Fork and Dry Fork) is possible if the

soil surface subsides. The drainage pattern could be altered, or water from the streams or reservoirs could be lost to ground water through fractures within the geologic profile. It is impossible to estimate the extent of this impact because the amount of subsidence from any given location cannot be estimated.

Population increases, both directly and indirectly related to ARCO, have been projected for the North Fork valley (Socioeconomic Conditions). Increases of 900 persons by 1980, 2,800 persons by 1985, and 3,000 persons by 1990 have been estimated for the valley. Associated with these increases are increases in demand for municipal water supply. The demand for this treated water would increase by 350 acre-feet per year by 1980, 1,100 acre-feet per year by 1985, and 1,175 acre-feet per year by 1990. Paonia has a capacity of about 1,600 more people or 625 acre-feet per year of additional municipal water. So, the pressure of population increases would also affect Hotchkiss and Delta.

Ground Water

The amount of ground water that is encountered within any mining operation varies from mine to mine. Although the Bear Mine, beneath the proposed Mt. Gunnison No. 1 operation, is dry, water is expected to be found within the ARCO mine. The interuption of the natural ground water flow by ARCO would be an insignificant effect and would have no impact on domestic wells within the North Fork. Domestic wells within the valley utilize unconfined ground water which flows through the alluvial valley bottom. The Mesaverde formation is below this alluvium.

Water Quality

Allowing untreated runoff water to flow from disturbed areas into the North Fork of the Gunnison River would cause degradation of water quality of this river. Increases in suspended sediments, oil and grease,and salts would occur. Increases as high as 15 to 20 percent could occur during low summer flow periods. Treating the runoff water to comply with state or federal effluent limits (see chapter 3) before releasing it into the North Fork would resolve this problem.

The construction of the access road south of the North Fork River creates a potentially severe impact to the river. The proposed paving with either asphalt or concrete would minimize the erosion and subsequent sediment loading of the river; however, oil and grease concentration would increase within the North Fork of the Gunnison River. The extent of this impact is dependent upon the condition of the vehicles using this road. Old, leaky cars and trucks would drip more oil along the road than newer, clean cars and trucks.

Flood Hazard

There is no danger of flash flooding in the area of the Mt. Gunnison Mine facilities. The mine is situated up on a bench 40 to 200 feet above the North Fork River with no gullies or drainage channel running through the area.

Half of the refuse pile would be within an unnamed, dry drainage located to the west of the facilities. Adequate drainage around the refuse has been proposed, and the refuse would be high enough on the ridge that there would be no danger that the pile would undercut and erode.

Soils

Soil impacts would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban area expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 3.5 feet (see Topography). Soil impacts would be minimal where no breaks occurred in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

The construction and operation of surface facilities would affect approximately 77 acres by 1980, 91 acres by 1985, and 106 acres by 1990. Erosion rates would increase in response to surface disturbance. Within soil unit 2 (see figure AR2-3, in chapter 2, Soils), which covers much of the portal and refuse disposal sites, erosion could increase by as much as 10 times over the low natural rate. Units 17 and 74, where the preparation plant and loadout facilities are proposed, could show up to a fivefold increase. Within the design limitations of the proposed action, most of this erosion would be contained on-site by drainage systems and other sediment control measures. However, these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology section). Over the 27-year mine-life there is a 94 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration in soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable, would complicate but would not preclude successful reclamation.

Off-site disturbances due to mine-related population increases would amount to 77 acres by 1980, 238 acres by 1985, and 255 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come

from croplands in Delta County. To this extent, crop production capacity would be permanently lost. Soil erosion could initially increase from two to seven times the natural rate, then gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

Construction and operation of the proposed mine portal facilities, preparation plant, refuse pile, and access road would disturb 77 acres of natural vegetation on land owned or leased by ARCO by 1980, 91 acres by 1985, and 106 acres by 1990. The acreage disturbed by 1990 would be largely in the mountain brush type (60 percent-64 acres). Other vegetation types that would be disturbed to a lesser extent include aspen (1 percent-7 acres), agricultural land (8 percent-8.4 acres), and dry meadows (25 percent-26.6 acres). The dry meadows are either natural openings within the mountain brush or aspen types (usually on exposed slopes or ridges) or past clearings of the native vegetation for dryland pastures. The agricultural land consists of irrigated and dryland pastures or of cropland usually planted in alfalfa. The impacts of the disturbance would be to reduce the visual aesthetics of the area, increase soil erosion, and reduce the numbers of wildlife and livestock in the area (discussed in the appropriate sections).

ARCO would be required to revegetate the 106 acres of disturbance at the Mt. Gunnison mine site upon abandonment of the mine. Specific revegetation measures that would be required by the federal coal mining regulations are stated in 30(CFR): 717.20, and 30(CFR): 211.40, 211.41, and 211.62, in the Federal Register (Vol. 42, No. 239, and Vol. 41, No. 96). These regulations cover the operator's (ARCO's) responsibility and length of liability for revegetation; 30(CFR): 211.40(a)(13)(i) states that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vagetation, shall be established on regraded and other affected lands.' It is expected that successful revegetation of the disturbed areas is possible within the five-year minimum time frame as stated in 30(CFR): 211.40(a)(13)(ii), since the Mt. Gunnison mine site has a relatively high annual precipitation amount.

It is anticipated that the 2 cfs of water ARCO plans to divert from the North Fork of the Gunnison River would have no effect on the riparian vegetation along the river. Two cfs is a very small part of the 648 cfs average annual flow of the North Fork.

Urban expansion caused by population increases related to coal mining would result in the disturbance of an estimated 77 acres of vegetation by 1980, 238 acres by 1985, and 255 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers and crop production capacity on these lands would be permanently lost.

Increased numbers of people in the area would result in additional disturbance of native vegetation, particularly by off-road-vehicle use (see Recreation). This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Wildlife

The proposed development would not impact most of the wildlife habitat on the site. However, construction of mine portals, aboveground facilities, roads, and the waste disposal site would destroy 77 acres by 1980, 91 acres by 1985, and 106 acres of habitat by 1990; this habitat is not considered crucial winter range for deer or elk. (See table AR3- 1 for the total number of deer and elk which would be affected.) Deer mice and golden mantled ground squirrels would also be deprived of habitat on these acres. Small mammal dens would be destroyed along with the immobile or slower species of animals that inhabit the area. In addition, approximately 260 acres immediately adjacent to these facilities would be used less by big game species due to increased human and mechanical activity. This reduction would be an average of 50 percent on these adjacent 260 acres (assuming that impacts would be progressively less, the farther the habitat is from the disturbance.)

The number and location of air shafts to be developed are not known, but construction and maintenance of shafts and fans could impact crucial deer and elk winter range. Increased harassment of animals and loss of forage could reduce the number of animals supported on the winter range. The extent of this reduction is unknown because the number and location of the airshafts is unknown. Furthermore, if the air shafts and maintenance roads are close to the golden eagle nest then it could be abandoned due to increased human activity.

It is difficult to predict to what extent subsidence would affect wildlife because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Secondarily, individual animals could be frightened by humans in the area (mineworkers, sightseers, etc.) and driven into the subsidence area where they could be injured or killed by the sharp changes in topography. To some extent, however, wildlife would gradually develop trails through the areas, which would lesson the danger for wildlife.

TABLE AR3-1

IMPACTS ON WILDLIFE

Year	Total Disturbed Acres	Number of Animals that These Acres Could Support					Additional Acres Disturbed	Additional Animals that Could be Supported		
		DDA	D	EDA	E	WH		D 50%	E 50%	WH 50%
1977	0	99	0	3.6	0	-	-	-	-	-
1980	77	99	46	3.6	5	-	260	78	8	-
1985	91	99	56	3.6	6	-	260	78	8	-
1990	106	99	65	3.6	7	-	260	78	8	-

Note: DDA = deer days per acre; EDA = elk days per acre; D = deer; E = elk; WH = wild horses.

Increased traffic on Highway 133, bringing miners and supplies to the ARCO mine, could increase vehicle-deer collisions from eight to twenty (see table R4-8) and increase the loss of small mammals and birds. Improved roads could also result in increased harassment and poaching of animals. This poaching could increase ten times over present illegal kill estimates. (Al Whitaker 1978, personal communication).

Increased activity along the Gunnison River would adversely affect waterfowl which hunt along the river, along with many songbirds and small mammals attracted to the riparian zone. This activity would affect about 0.5 mile of river bottom not presently impacted by existing mine activity.

Power lines to the mine and perhaps to air vents would be physical hazards to raptors in flight. If not properly designed, power lines could also be electrocution hazards to the large hawks and eagles in the area.

Secondary impacts from the proposed action would include increased human population, resulting in expansion of urban areas onto agricultural lands and some crucial winter range; increased vehicular traffic, resulting in an increase in vehicle/animal collisions; and increased recreational use of the area, causing an additional stress on the animals and increasing legal and illegal harvest of animals.

Endangered or Threatened Species

The increased activity along the Gunnison River mentioned above could also affect the bald eagle. The presence of people is enough to discourage the bald eagle's use of that stretch of river. The extent of this disturbance would depend on the frequency of human activity and its duration.

Aquatic Biology

The ARCO mining plan does not present a site drainage plan to contain sediment and runoff from all construction and operation areas. It is assumed that they will design a plan in conformance with 30(CFR): 717.17; such a system should control sediment from the site if properly designed.

Any discharge water with total suspended solids greater than 45 milligrams per liter would be in violation of 30(CFR): 717.17. Increased sediment yield as described in the water resources and soils sections would have an adverse impact on aquatic insects and trout in the North Fork. Particles of sediment settling into the stream bed would fill the interstices of the bed and reduce the natural habitat of stream insects. Gravel areas of the stream bed, which are essential spawning areas for trout, would become filled with sediments, and spawning and egg incubation would be impaired. Sedimentation would seriously reduce the survival of trout embryos and fry, and increased populations of suckers would be expected.

The historical low flow for the North Fork is 17 cubic feet per second (cfs). ARCO has water rights for 15 cfs to be used during mine operation. If this amount of water is diverted from the North Fork during the late summer months in a low water year, the stream flow would be reduced by 25 to 100 percent. Commensurate losses in aquatic values would occur in the North Fork if the full diversion is taken during a low water month. However, it is not anticipated that this amount of water would be needed and ARCO could not divert this amount during low flow months without compensation for injury to senior downstream water rights. However, without a minimum stream flow established by the state of Colorado in this section of the North Fork, the fishery may be vulnerable to dewatering.

Any inadvertent discharge of contaminated water from mining activities would cause a loss of fishery and a degradation of aquatic resources in this stream. Breakage of the settling pond could cause a complete destruction of aquatic life in the North Fork, which would be in violation of 30(CFR): 717.17 regulations.

Discharge from detention ponds and sewage treatment lagoons on the site may potentially increase ammonia (NH_4) and decrease the dissolved oxygen concentration in the North Fork River system. These parameters are presently near the limiting concentration for aquatic life in the lower North Fork and the Gunnison River near Delta. Any additional NH_4 discharge to the North Fork could cause fish kills in the river at Delta.

Increased population would add additional stress to existing municipal waste water treatment facilities. Sewage treatment systems in Delta and the North Fork Valley are presently inadequate and ammonia would increase and dissolved oxygen would decrease in the river until planned improvements in waste water treatment facilities are built and operational (see regional analysis).

Increased populations would increase fishing pressure on the river causing an increased dependence on hatchery trout and a decrease in wild trout populations. The lakes on Grand Mesa, the Gunnison River in the Gunnison Gorge, and Anthracite Creek are the nearest quality fisheries and would receive substantial increases in fishing pressure. Construction of coal mining facilities adjacent to the North Fork of the Gunnison would discourage fishermen from using the area.

Endangered or Threatened Species

No endangered or threatened aquatic species would be affected by the proposed action.

Cultural Resources

Archeological Resources

Although prehistoric use is not unknown in the North Fork Valley, the lack of identified archeological values within the Mt. Gunnison Mine area suggests that there should be no impacts to archeological values from the proposed action.

Historical Resources

Because the extent of historical sites in the mine area is not fully known, the following impacts may occur. Surface distrubing activities, such as mining or construction of facilities and roads, could disturb buried sites or destroy sites that might be considered worthless by the project's engineers. Because of the intrusion of buildings, roads, fences, etc., some sites might lose the aesthetic integrity which is important to the overall quality of the site (as outlined in 36(CFR): 800.9). Sites remaining near or at the project might be vandalized due to increased access or human use; damage could include 'stripping' of wood, removal of artifacts, etc.

Transportation

Highways

When State Highway 133 is reconstructed as planned, it would be adequate to handle any increase in traffic generated by the ARCO mine. The major impact on transportation would be the increased traffic generated by workers traveling to and from the mine. This could be as many as 750 trips per day. There would be an increase in the number of accidents due to the heavier traffic on the road. Congestion would also increase travel time through the area. The greatest congestion would be just before and after shift changes at the mine. An access road to the mine from highway 133 would have to be constructed; this road would cross the North Fork River east of Somerset to the south side of the canyon.

Railroads

Coal from the Mount Gunnison Mine would be shipped over the existing Denver and Rio Grand Western lines in unit trains. Supplies to the mine would arrive by rail. A 10,000 foot siding is planned as part of the proposed loading facilities. At full production, from four to five unit trains per week would be required to move the coal. This would increase the possibility of auto-train collisions at crossings on the line and would increase the average delay at crossings. This delay could affect emergency vehicles using the system. It would also increase train congestion at Grand Junction and at other cities the trains pass through.

Airports

Both the Montrose and Grand Junction airports would experience an increase in passengers as a result of population increase associated with this mine. No upgrading of facilities would be necessary.

Livestock

Construction of the proposed surface facilities and refuse pile would disturb 77 acres of mountain shrub, aspen, and dry meadows by 1980, 91 acres by 1985, and 106 acres by 1990. As a result, 11 animal unit months (AUMs) of livestock forage would be lost annually by 1980, 13 AUMs by 1985, and 15 AUMs by 1990. This reduction in AUMs is less than 1 percent of the total AUMs on the lease tract, and would not result in severe hardship to the livestock operators using the lease tract.

The disturbed area would be revegetated after the mine is abandoned, approximately 28 years after production is started. A revegetation cover consisting mainly of grasses, as indicated in ARCO's reclamation plan, would provide 43 AUMs per year in the disturbed area, a net increase of 25 AUMs after revegetation is completed.

It is very likely that some of the acreage disturbance resulting from urban expansion due to increased population (76 acres in 1980, 238 acres in 1985, and 255 acres in 1990) would be on irrigated and nonirrigated hayland and pasture. This would adversely impact the livestock industry because these lands are used as livestock wintering areas, and the hay harvested from them in the summer is used to feed the livestock during winter.

Recreation

The influx of additional population due to the ARCO Mine and the subsequently increased need for recreational facilities may have an impact on the surrounding communities (see table AR3-2). The 1976 Colorado Comprehensive Outdoor Recreation Plan identifies a need for active, improved parks (e.g., ball fields and tennis courts), so increased demand would require construction of new facilities; approximately 10 acres of improved parks would be needed by 1990, at a cost of $200,000. If additional facilities are not provided, the overuse of present facilities could lead to their deterioration and lower their capacity to provide enjoyable recreation.

The construction of mining facilities would remove 77 acres of land suitable for dispersed recreation (e.g., hunting, fishing, camping) by 1980, 91 acres by 1985, and 106 acres by 1990. This impact is considered insignificant, however, because this type of land is available throughout the region. This increased demand for dispersed activities

would not by itself overtax the existing resources; however, when combined with additional demands resulting from other population increases in the region, there could be a cumulative adverse impact (see Recreation in the regional analysis).

The increased use of recreation or facilities could be offset by providing additional facilities. The Heritage Conservation Recreation Service, through the Land and Water Conservation Fund Act (PL88-578), could provide monies for this purpose if matching funds are provided by the local agency. The mineral leasing funds (Colo. SB No. 35, Sect. 2, 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreation facilities under the Recreation and Public Purposes Act, 43(CFR): 2740, which allows nonprofit associations to acquire lands for recreation purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior; therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The impact of the ARCO mine on the visual resource could also be a recreation impact for sightseers. State Highway 133 is the main access road to the Paonia State Recreation Area and portions of the Gunnison National Forest; it received approximately 210 vehicles per day in 1976 (Colorado Division of Highways 1976). See Visual Resources for the significance of this impact.

The placement of access roads to ventilation fans within the area indicated by the USFS as a roadless study area (see map AR2-4, chapter 2) prevent its inclusion into the wilderness system (USFS Wilderness Criteria).

Visual Resources

The addition of a coal preparation plant, conveyor systems, storage silos, surge bins, rail loadout facilities, and other surface facilities as proposed by ARCO would establish a large, industrial operation to replace the Bear Mine. Cut-and-fill sites and large structures constructed on the valley floor would reduce any balance that presently exists between the natural and modified environments. The increased scale of mining operations would introduce its own textures, lines, and colors that would dominate the immediate landscape.

In particular, the continuous vegetative texture of the surrounding hills would be interrupted by the 75-acre refuse area on the terrace above the central facility; the approximately 57 feet of waste per acre would create a new landform on a high piece of ground. The combined effects of surface facilities would intensify the landscape's Class V designation, which stipulates the eventual need for rehabilitation.

TABLE AR3-2

ARCO: ADDITIONAL COMMUNITY RECREATION FACILITIES DEMAND

	1980	1985	1990
Population growth	900	2,800	3,000
Active/improved parks a/ (3.3 acres per 1,000 residents)	3.0 acres	9.2 acres	9.9 acres
Capital investment (66,666 per 1,000 residents)	$59,999	$186,665	$199,998

Source: Bickert, Browne, Coddington, and Associates, Inc., Boomtown Financing Study, Vol. II, July 1976.

a/ Ballfields, tennis courts, playgrounds, etc.

The expansion of the plant facilities would be accompanied by more power lines, roads, and bridges, increased vehicle and railroad traffic, etc., in the narrow valley. The associated visual charges would locally transform the valley landscape into an urban/industrial corridor with reduced scenic potentials.

Socioeconomic Conditions

Demography

The ARCO operation is expected to add about 900 persons to the county population by 1980, about 2,800 persons by 1985 when full-scale operations are achieved, and a total of 3,000 persons by 1990. This population directly attributable to ARCO would account for about 4 percent of the total county population by 1980 and about 9 percent by 1985 and 1990.

ARCO hopes that the majority of the company's workers can reside in the Paonia area. This may happen if property the company owns south of Paonia is developed for residential use. However, the existing condition of the town's treated water system would limit growth in the community to about 1,600 persons, enough to accommodate much of the ARCO workforce and their families, but very little other population growth. Attaining this level of population would more than double the existing size of the town and require extensive expansion of the town's sewage treatment system.

Both the town of Hotchkiss and the city of Delta would be directly affected by population growth due to the ARCO mining operation. These areas would have to absorb the people who were not able to settle in Paonia. As recent experience has shown, some of these people would settle in the unincorporated areas of Delta County.

Community Attitudes and Lifestyle

The discussion of changes in community attitudes and lifestyles contained in the regional volume, chapter 4, is applicable to the area affected by ARCO. This particular operation, more than any other single proposal evaluated in the ES, would serve to establish coal mining as the dominant economic force and way of life in the North Fork Valley.

Community Facilities and Services

The community facility requirements associated with the ARCO operation are listed in table AR3-3. These figures were derived in a similar manner to those contained in the regional volume in table R4-9.

Increases in local property and sales tax revenues attributed to the ARCO development are listed in table AR3-4. These property tax revenues are based on a county-wide average mill levy which includes the school district mill levy. If the school district share is taken out, the property and sales tax revenues which would be expected to flow to county, municipal, or special districts would be $148,900 in 1980, $463,260 in 1985, and $596,330 in 1990. These revenues would be about enough to cover operating expenses for the county, city, and special district entities.

Part of the money paid by ARCO as royalties and taxes would be available to Delta and Gunnison counties. Chapter 3 of the regional volume explains the various laws that allocate money to the counties. Revenue that the counties would receive is outlined below.

The price of coal is assumed to be $20 per ton, and the royalty is assumed to be 8 percent. Table AR3-5 shows royalty payments for the three years allocated. Money from this fund would go to Gunnison County. The possibility exists that Delta County would receive some of the money from the impact fund.

The Colorado State Severance Tax is $0.30 per ton with the first 8,000 tons per quarter exempted; table AR3-6 shows what receipts would be from this project. Money from the local government severance tax fund is distributed to various local governments to help develop public facilities and provide public services. Fifteen percent of this fund is allocated to impacted cities and towns according to the percentage of employees of the mine living within the boundaries of the municipality or in the unincorporated area of the county. Delta County and the towns in the north fork area are expected to receive this money.

As explained in chapter 4 of the regional volume, $36 of investment is estimated to be required to produce a ton of coal. This would make the total investment for the ARCO project $87,696,000, the assessed value of which would be $26,308,800. Property taxes on this mine would be $1,249,400 per year in 1985 and 1990.

In addition, ARCO would pay property tax on the coal the company mines: $11,910 in 1980, $253,900 in 1985, and $290,240 in 1990. Total property tax from the Mount Gunnison Mine would eventually reach $1,539,640.

Delta County would realize increased revenues from the new people moving to the area in the form of higher property and sales taxes and water and sewer tax and service fees. Tap fees would be a one time source of revenue and would total $34,020 in 1980, $105,800 in 1985, and $1,040,000 in 1990. Annual revenues would be realized from the other sources and amount to $312,540 in 1980, $971,720 in 1985, and $1,041,820 in 1990.

Housing

The demand for new housing as a result of the population growth in Delta County attributed to

the ARCO operation is listed in table AR3-7, which is based on the assumptions that the average household size would be 3.0 persons and that a constant mix of 65 percent single-family units, 25 percent mobile-home units, and 10 percent multifamily units would be maintained (the same assumptions are used in the regional analysis). The projected housing requirements associated with ARCO amount to 25 percent of the total projected housing requirements for the county in 1980 and 1985. The vacant land necessary to support these housing requirements is estimated at 77 acres by 1980, 238 acres by 1985, and 255 acres by 1990. The land estimates include land for roadways.

Education

The expected increase in school-aged population due to the development of the ARCO mine is shown in table AR3-8, along with the increase in school capital requirements and operating costs expected from that population increase.

The school district would benefit from the $32.4 million in assessed valuation that is expected to be derived from the ARCO mine installation. Combined with an additional $11.1 million (see table AR3-4) projected increase in residential and commercial assessed valuation, the ARCO development would increase the district's bonding capacity by about $12.5 million by 1990.

Health Care

Population growth from the ARCO mine development is expected to increase the demand for health care services in Delta County. Table AR3-9 lists the capital facility requirements associated with this expected increase in demand for health care services.

These cost figures assume that most of the increase in health care services demand can be met by upgrading the hospital in Delta. However, other aspects of the health care service system would also be affected. More doctors would have to be brought into the area, mental health services would be expanded, and more extensive emergency services would be provided in the North Fork area to handle both mining related and other health emergencies.

Some of the expected costs associated with increased health care needs would be paid for by fees collected from patients. The county hospital relies on a levy of 2.3 mills to generate revenue for much of its capital requirements. The hospital's taxing jurisdiction includes only Delta County, which means that the hospital would not receive any benefits from the $32.4 million expected assessed valuation of the ARCO installation itself. The only increased tax base accruing to Delta County from ARCO would be that from new residential and commercial development resulting from population growth. Yearly revenues which would be generated from the present county hospital mill levy would be $7,680 in 1980, $23,880 in 1985, and $25,590 in 1990.

To debt finance the estimated $455,000 capital requirement for health care facilities, over twenty years at 6.5 percent interest, the yearly premium would amount to over $41,000, or nearly twice the expected property tax revenues.

Employment

Even though the Mount Gunnison mine is located in Gunnison County, the social and economic impacts are expected to occur in Delta County, particularly in the Paonia area. In 1977, the ARCO exploration and planning effort is estimated to have increased employment in Delta County by 13 persons. By 1980, if the proposed schedule is followed, there would be 190 employees at the mine, and total employment in Delta County would increase by 378 people. By 1985, employment at the mine would be stabilized at 565 people. Total employment would increase by 1,442 persons by 1985 and by 1,496 persons by 1990. In 1976, total employment in Delta County was 5,942. By 1990, the ARCO project would cause a 25.5 percent increase in total employment in an area with a record of high unemployment.

Income

An operation of the magnitude proposed by ARCO would have a significant impact on regional income. The average income of mine personnel is projected by ARCO to be $13,600, considerably higher than the 1974 median family income of $7,550 in Delta County and $9,530 in Gunnison County.

At full production, the Mt. Gunnison mine would employ 565 persons. Total payroll for the mine is projected by ARCO to be $7,716,500. As explained in the regional volume, the circulation of this money through the region would generate another $4,012,600. Total direct, indirect, and induced regional income from the ARCO development would be $11,679,680. Table AR3-10 shows the number of employees, the payroll, and the total regional income generated.

TABLE AR3-3

ARCO: REQUIREMENTS FOR COMMUNITY FACILITIES IN DELTA COUNTY (BY 1990)

	Water Treatment	Sewage Treatment	Police Protection	Fire Protection	Streets and Roads	General Government	Libraries	Total Costs
Physical Plant Requirements	1.05 mgd	0.3 mgd	2 vehicles and 1,200 sq.ft.	1 vehicle and 3,000 sq.ft.	70.7 acres	750 sq.ft.	1,650 sq.ft. and 9,000 books	
Capital Costs	$918,000	$990,000	$80,400	$195,000	$2,278,000	$48,300	$121,875	$4,631,600
Operating Costs (per year)								
1980	$19,800	$14,500	$ 40,000	Volunteer	$29,100	$36,000	$ 7,500	$146,900
1985	61,500	45,000	110,000	Volunteer	81,200	90,000	23,200	410,900
1990	65,880	48,300	120,000	Volunteer	87,500	97,200	24,900	520,100

Note: mgd = million gallons per day; sq.ft. = square feet.

TABLE AR3-4

ARCO: INCREASED PROPERTY TAX REVENUES FOR DELTA COUNTY

Delta County	1980	1985	1990
Increased Assessed Valuation	$3,337,460	$10,383,610	$11,124,870
Mill Levy	0.06296	0.06296	0.06296
Tax Revenues	$210,000	$653,760	$700,420

TABLE AR3-5

ROYALTY PAYMENTS TO GUNNISON COUNTY

Year	Royalty Receipts	Public Schools	Conservation	Impact Fund	Counties
1980	$ 80,000	$ 20,000	$ 8,000	$ 12,000	$ 40,000
1985	1,704,800	1,078,600	170,480	255,720	200,000 a/
1990	1,948,800	1,261,600	199,880	292,320	200,000 a/

a/ Revenue to a county is limited to $200,000 in any one year. The rest of the 50 percent goes into the State School Fund.

TABLE AR3-6

RECEIPTS TO STATE AND COUNTIES FROM STATE SEVERANCE TAX

Year	Total Receipts	State General Fund	State Severance Tax Trust Fund	To Local Government Severance Tax Fund
1980	$ 20,400	$5,100	$ 6,120	$9,180
1985	629,000	0	0	0
1990	721,000	0	721,000	0

TABLE AR3-7

ARCO: NEW HOUSING REQUIREMENTS IN DELTA COUNTY

Year	Single Family Units	Mobile Homes	Multi-Family Units	Total Units
1980	195	75	30	300
1985	607	233	93	933
1990	650	250	100	1,000

TABLE AR3-8

ARCO: SCHOOL REQUIREMENTS IN DELTA COUNTY

District 50(J)	1980	1985	1990
Increase in Students	250	550	575
Facility Requirements	35,000 sq.ft.	7,000 sq.ft.	80,500 sq.ft.
Facility Costs	$1,575,000	$3,465,000	$3,622,500
Operating and Maintenance Costs	$307,500 per year	$676,500 per year	$707,250 per year

Note: sq.ft. = square feet.

TABLE AR3-9

ARCO: PROJECTED HEALTH CARE FACILITY REQUIREMENTS IN DELTA COUNTY

Delta County	1980	1985	1990
Facility Requirements	3 hospital beds	7 hospital beds and 1 emergency vehicle	8 hospital beds and 1 emergency vehicle
Costs	$165,000	$400,000	$455,000

TABLE AR3-10

ARCO: EMPLOYMENT, PAYROLL, AND TOTAL REGIONAL INCOME

Year	Employment	Payroll (dollars)	Regional Income (dollars)
1980	190	2,584,000	3,927,680
1985	565	7,684,000	11,679,680
1990	565	7,684,00	11,679,680

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce or eliminate specific adverse impacts of Atlantic Richfield Company's (ARCO's) proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the mining and reclamation plan is approved, they would be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

ARCO Mitigating Measure 1

ARCO will be required to reach an agreement with Minnesota Creek and Ditch Company concerning loss of irrigation water, should subsidence occur, and replacement of that lost water to the satisfaction of both parties.

ARCO Mitigating Measure 2

ARCO will construct its access road by insloping the surface and either construct a concrete ditch or use culvert material to convey runoff water downhill.

ARCO Mitigating Measure 3

If it is determined that construction and maintenance of air shafts and fans would impact crucial winter range, then construction will be prohibited between December and April to avoid unnecessary harassment of animals on winter range.

ARCO Mitigating Measure 4

Power lines and associated poles will be raptor-proofed in accordance with Bureau of Land Mangement (BLM) standards as presented in BLM Manual 2850 and Instructional Memorandum No. CO78-30 (February 10, 1978).

ARCO Mitigating Measure 5

Night hauling of coal by truck from the mine to the rail facility will be eliminated in order to reduce the possibility of vehicle/wildlife collisions.

ARCO Mitigating Measure 6

If it is determined by BLM, U.S. Fish and Wildlife Service, and the Colorado Division of Wildlife at an on-site inspection that the eagle nest will be impacted by roads and/or ventilation shafts, then activity will be relocated so as not to disturb the eagles. No actual disturbance to the nest itself will be permitted at any time.

ARCO Mitigating Measure 7

The U.S. Forest Service wilderness criteria allow ventilation fans to be placed within the roadless study area; however, construction and maintenance will have to be done by means other than roads, possibly by air.

Analysis of Effectiveness

ARCO Mitigating Measure 1

The effectiveness of this measure would depend upon the actual agreement reached between Minnesota Creek and Ditch Comapny and ARCO.

ARCO Mitigating Measure 2

Construction of the road as described would minimize increases in sediments to the North Fork River.

ARCO Mitigating Measure 3

Effects of restricting use and construction on winter range to the period of April to December are difficult to quantify, but lack of restrictions would cause animal deaths.

ARCO Mitigating Measure 4

Raptor-proofing power poles will prevent electrocution of eagles or other large birds.

ARCO Migigating Measure 5

Reducing the number of vehicles on the road during the dusk to dawn hous would reduce the road kills by an unquantifiable amount.

ARCO Mitigating Measure 6

Relocation of human activity away from the eagle nest would allow the eagles to establish nests and rear their young without harassment. Prohibiting activity around the eagle nest could result in

more eaglets being fledged from that nest (about one per year).

ARCO Mitigating Measure 7

Construction and maintenance of ventilation fans by helicopter or some such means would maintain the integrity of the roadless study area.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by the construction and operation of Atlantic Richfield Corporation's (ARCO's) proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

The Mt. Gunnison No. 1 Mine would increase annual average particulate concentrations by 1990 5 micrograms per cubic meter ($\mu g/m^3$) in a small area on the mine site near the preparation plant. Concentrations are predicted to increase by 1 $\mu g/m^3$ within 0.3 mile north and south and 0.8 mile east and west from the surface facilities. With winds from the west, a maximum concentration of 19 $\mu g/m^3$ is projected to occur about 0.2 mile up the canyon near the eastern property line. With winds from the east, the maximum concentration is predicted to be 14 $\mu g/m^3$ at 0.2 mile. Visibility would be reduced by about 4 miles on annual basis in 1990; the reduction in visibility would be less in 1985.

Geologic and Geographic Setting

Topography

The proposed mining operation would result in minor alterations of the surface from installation, use, and removal of surface facilities and the subsequent reclamation of the area. Subsidence of a maximum of 3.5 feet would likely occur over the coal bed. Due to the speed with which the coal would be extracted, surface fracturing and slumping would be minimized. However, some erosion and hazard potential would exist.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

Mineral Resources

The mining of coal uner the Mt. Gunnison No. 1 M&R plan would have an unavoidable effect on the coal seams and coal reserves since deposits of a nonrenewable energy source would be depleted. Based on company estimates, 59.4 million tons of coal would be mined from the F seam by 2007, representing about 14.6 percent of total lease reserves or about 1.9 percent of the total Somerset area coal reserves over 42 inches in thickness. Because of the nature of underground caving and resultant high contamination from mining, future recovery of the unrecoverable 50 percent of the F seam coal reserves is not considered feasible under present mining technology and therefore those reserves must be considered as lost.

Water Resources

The flow of the North Fork of the Gunnison River would decrease 0.79 to 1 cubic foot per second because of consumptive use by the Mt. Gunnison Mine.

There would be an increased consumption of municipal water of 350 acre-feet per year in 1980, 1,100 acre-feet per year in 1985, and 1,175 acre-feet per year in 1990.

Soils

Surface disturbance on approximately 77 acres by 1980, 91 acres by 1985, and 106 acres by 1990 at the mine site would cause an increase in erosion and a deterioration of soil structure and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would prolong the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 77 acres by 1980, 238 acres by 1985, and 255 acres by 1990 from a production function. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine site on 77 acres in 1980, 91 acres in 1985, and 106 acres in 1990. If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than these figures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action.

Wildlife

There would be 77 acres of wildlife habitat lost in 1980, 91 acres in 1985, and 106 acres in 1990 and reduced wildlife use on an additional 260 acres. The increased activity along the Gunnison River could cause some reduction of hunting areas for bald eagles; reduced waterfowl nesting and resting; and stress and harassment of big game species.

Aquatic Biology

There would be some minor increases in sediment yield from the construction sites to the river. Stream flow depletion resulting from water diversion would cause an unavoidable loss of aquatic habitat if the diversion exceeds 25 percent of the stream flow.

Increased waste water treatment plant discharges to the river would result from increased populations in the area, and the aquatic habitat would be impacted until all planned facilities are operating effectively. Increased fishing pressure in the area would increase the dependence on hatchery raised fish.

Transportation

The most serious impact would be increased accidents from greater train and automobile traffic. Congestion and more trains would also cause delays and slow traffic flow. Airline passenger traffic would increase at area airports.

Livestock

The following livestock forage would be lost: 11 animal unit months (AUMs) per year due to disturbance of 77 acres in 1980, 13 AUMs per year due to disturbance of 91 acres in 1985 and 15 AUMs per year due to the disturbance of 106 acres in 1990. Increased off-road vehicle use would decrease productivity of natural vegetation by an unquantifiable amount. Agricultural lands disturbed by urban expansion would result in the loss of an unquantificable amount of livesotck forage and livestock wintering areas.

Recreation

If the community recreation facilities needed to prevent deterioration of existing facilities are not provided, this deterioration would be an unmitigated impact.

Visual Resources

During the mining period, there would be a definite alteration of the natural landscape since visually incongruous elements of the proposed action cannot be mitigated. Cut and fill scars, refuse overburden, vegetation cuts, and new structures would remain apparent in the landscape for the life of the mine. Offsite land use alterations for employee housing would contribute to an urbanization process which would also remove lands from their natural condition. The post-mine reclamation process would rehabilitate some of the affected landscapes, but those acres used for community development would be permanent landscape changes.

Socioeconomic Conditions

The development of the ARCO mine would have a pronounced effect upon the rate of population growth in Delta County, especially in the North Fork area. New population directly attributable to the ARCO mine would be 900 people by 1980, 2,800 people by 1985, and 3,000 people by 1990 and would account for over 9 percent of the total county population by 1985.

If most of this new population is concentrated in the North Fork area, it would more than double the size of the small communities of Paonia and Hotchkiss. The large influx of outsiders into the North Fork Valley would destroy some of the rural character of the area, which is valued highly by existing residents. It would also place strong pressures for rapid growth and development on a political and social structure which has voiced a strong concern for preserving a high level of environmental quality.

Higher incomes among miners than among present residents would cause increases in the cost of living in the area. People on fixed incomes would be hard pressed. In addition, the industrialization and rapid population growth associated with the coal mine may discourage the migration of retirees and others to the area, who have come primarily because of the existing environment and lifestyle. Rapid growth would also cause higher crime rates and higher divorce rates.

The communities of Paonia and Hotchkiss are expected to be most burdened financially, as they would receive little increase in tax base but would be required to provide greatly expanded services to the new population. Providing adequate water and sewage treatment services would be a major prob-

lem in both of these communities because present facilities are limited, and both communities have assumed recent debt primarily to upgrade their existing deteriorated systems.

Providing adequate health care services to the mine and the communities in the North Fork would require additional facilities in that area. At a minimum, more emergency medical services would be needed in the North Fork, along with more physicians located in the area.

The conversion of land from agricultural use to urban use to provide for population increase is an adverse effect in the opinion of most Delta County residents. This conversion would diminish the area's agricultural base and increase the economic dependence on coal mining. It is estimated that about 77 acres of land would need to be converted to urbanized use to support population resulting from ARCO by 1980, 238 acres by 1985, and 255 acres by 1990.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 59.4 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment.

There would be the following alterations in the short term, a period beginning with on-site construction and ending with end of mine life (about 2007) and post-mining reclamation:

1. An estimated 59.4 million tons of coal would be exported out of the area to utility plants for use in the production of electrical energy.
2. Annual average particulate concentrations would increase by 5 micrograms per cubic meter ($\mu g/m^3$) near the mine site and by 1 $\mu g/m^3$ within 0.3 mile north and south and 0.8 mile east and west through 1990. Maximum concentrations about 2 miles up the canyon would be 14 to 19 $\mu g/m^3$
3. There would be loss of soil productivity on 106 acres through 2007 due to increased erosion, deterioration of soil structure, and reduced biological activity, and there would be loss of vegetation on those 106 acres through 2007 due to loss of soil productivity.
4. Wildlife habitat on 106 acres, which could have supported 65 deer and 7 elk annually would be completely lost through 2007.
5. Increased waste water treatment plant discharges to the river would result from increased populations in the area, and the aquatic habitat would be impacted until all planned facilities are operating effectively.
6. Accidents would increase as a result of greater train, automobile, and truck traffic.
7. Approximately 15 animal unit months (AUMs) of livestock forage would be lost annually through 2007.
8. During the mining period, there would be a definite alteration of the natural landscape since visually incongruous elements of the proposed action cannot be mitigated. Cut and fill scars, refuse overburden, vegetation cuts, and new structures would remain apparent in the landscape through 2007.
9. Higher incomes among miners than among present residents would cause increases in the cost of living in the area. People on fixed incomes would be hard pressed. In addition, the industrialization and rapid population growth associated with the coal mine may discourage the migration of retirees and others to the area, who have come primarily because of the existing environment and lifestyle. Rapid growth would also cause higher crime rates and higher divorce rates.
10. The revenue generated by local property and sales taxes in Delta County from the ARCO development would fall far short of the increased expenditures which would be needed for community facilities and services in the county through 2007.

Residual effects of mining (after post-mining reclamation) on long- term productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.
2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.
3. An estimated 59.4 million tons of coal, a nonrenewable energy resource, would be depleted after 2007.
4. There would be an increased consumption of at least 1,175 acre- feet of municipal water per year through 2007 and beyond.
5. Soil and natural vegetative productivity would be permanently lost on 255 acres due to urban expansion.
6. Surface construction, subsidence, and vandalism would disturb or destroy an unquantifiable number of nonrenewable cultural resources.
7. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present facilities would be a long-term adverse impact.
8. Approximately 43 AUMs of livestock forage per year would be restored on the lease

area upon reclamation after the mine is abandoned.

9. Offsite land use alterations for employee housing would contribute to an urbanization process which would also remove lands from their natural condition. The post-mine reclamation process would rehabilitate some of the affected landscapes, but those acres used for community development would be permanent landscape changes.

10. At least 255 acres of land would be permanently converted to urban use by 2007, which would diminish Delta County's agricultural base and increase economic dependence on coal mining.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 59.4 million tons of coal would be recovered from the Loma project mine. About 59.3 million tons would be unrecoverable by current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 106 acres for the life of the mine, and irreversibly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 106 acres, which could have supported 65 deer and 7 elk annually would be irretrievably lost for the life of the mine.

Approximately 15 animal unit months of livestock forage would be irretrievably lost for the life of the mine. An unquantifiable amount of livestock forage and livestock wintering areas would be irreversibly lost due to disturbance of agricultural lands by urban expansion.

An irretrievable commitment of capital and land (at least 225 acres) would be required to support population growth.

Particulate air quality at the proposed mine site and for a very limited area surrounding the mine will be subject to a slight increase in concentrations. Air quality will be temporarily degraded during the mine life, but the change will not be irreversible. With termination of mining activity in 2007, air quality will return to the premining level of about 20 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean from the levels during mining of 20-25 $\mu g/m^3$.

Reduction in visibility will occur in proportion to the increased particulate concentrations. Average visibility is presently about 54 miles. Given the limited increase in predicted concentrations resulting from mining activity, visibility will not be greatly affected (50 miles) and the loss will be reversible. However, secondary development related to the proposed action will result in some permanent degradation of visibility over the surrounding area.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan and the associated railroad right-of-way are not approved. Rejection of Atlantic Richfield Corporation's (ARCO's) proposed M&R plan would result in no additional environmental impact from coal mining on the federal leased lands. Since these lands are public lands surface use would be governed by Bureau of Land Management (BLM) and U.S. Forest Service (USFS) policy and management guidelines and decisions. ARCO could submit a new M&R plan, challenge the rejection, or abandon development of the lease.

Coal from the proposed Mt. Gunnison mine is intended to supply 59.4 million tons of coal to utility plants outside Colorado for use in the production of electrical energy. Without the Mt. Gunnison mine, other coal would have to be acquired to supply these markets. Such a substitution could create a shortage for other coal markets.

The primary use of the vegetation would be livestock and wildlife forage. The public land within the ARCO tract would be converted to a three-treatment rest-rotation grazing system of livestock production, seed trampling, and rest, as proposed in the Jumbo Mountain allotment management plan.

Continuing human population growth in Delta County would still cause impacts to wildlife: expansion of urban areas onto agricultural lands and some winter range; increased recreational use of wildlife species, primarily hunting; and increased poaching of big game species.

Natural weathering and vandalism would continue to be the major causes of loss of archeological and historical values, but there should be no additional contributing factors to such loss at the site if the M&R plan is rejected. Paleontological resources would be impacted both adversely and beneficially in approximate proportion to the level of regional development and the area disturbed.

The population of Delta County would increase to 21,129 people in 1980, 25,001 people in 1985, and 29,375 people in 1990. The area would remain basically dependent upon agriculture and tourism. Incomes would remain much below the state and national levels, and unemployment would continue to be a problem.

Gunnison and Delta counties, towns, special districts, and the school district would not receive increases in revenue amounting to $324,450 in 1980, $2,475,020 in 1985, and $2,581,460 in 1990. Of course expenditures to provide facilities and services to accommodate population increases associated with ARCO would not have to be made. Total income in the county would be reduced by $3,927,680 in 1980, and $11,729,100 in 1985 and 1990.

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transports, and rates of production have been considered but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geology and geographic characteristics of the area. Any new alternatives presented by the review process will be carefully considered.

MID-CONTINENT COAL AND COKE:

COAL CANYON MINE

CHAPTER 1

DESCRIPTION OF THE PROPOSAL

Proposed Action

The proposed action is the review and consideration for approval of a mining and reclamation plan (M&R plan) submitted October 13, 1977, to the Office of the Area Mining Supervisor, U.S. Geological Survey (USGS), Denver, Colorado, by Mid-Continent Coal and Coke Company (Mid-Continent) for Mid-Continent Limestone Company. The M&R plan for the Coal Canyon Mine has been accepted by the USGS as suitable for use in preparing this environmental statement (ES) and is available for public review at the Area Mining Supervisor's Office in Denver.

This M&R plan was submitted for review prior to promulgation of the initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act (SMCRA) of 1977 (PL 95-87) and has not been officially reviewed for compliance with that act. Therefore, the applicant's plans may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations.

The M&R plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plan is revised and returned to USGS, it will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulations 30(CFR): 211 and 30(CFR): 700. The M&R plan cannot be approved until it conforms to all applicable federal requirements.

The Coal Canyon Mine would be a new underground mine approximately 15 miles northeast of Grand Junction, Colorado, and approximately 4.5 miles north of Palisade, Mesa County, Colorado. Production would be from federal coal leases C-037277, C-059420, and D-040389. Coal lease C-037277 consists of 1,471 acres; it was issued to Coal Canyon, Inc., October 1, 1962, and assigned to Mid-Continent Limestone Company in November 1972. Coal lease C-059420 consists of 308 acres; it was issued to Coal Canyon, Inc., in October 1, 1965, and assigned to Mid-Continent Limestone Company in November 1972. Coal lease D-040389 consists of 241 acres reassigned to Mid-Continent Limestone Company in May 1932. (Map MA1-1 shows their locations.) (Note: The federal lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.)

The Coal Canyon Mine is designed to produce 500,000 tons of mine run coal per year for an anticipated mine life of 15 to 25 years based on total potential reserves estimated for the two coal beds to range from 15 to 25 million tons depending on the mineability of the Palisade coal bed. The Cameo bed to be mined averages 9.1 feet in thickness and contains 8 million tons of recoverable coal in the proposed project area.

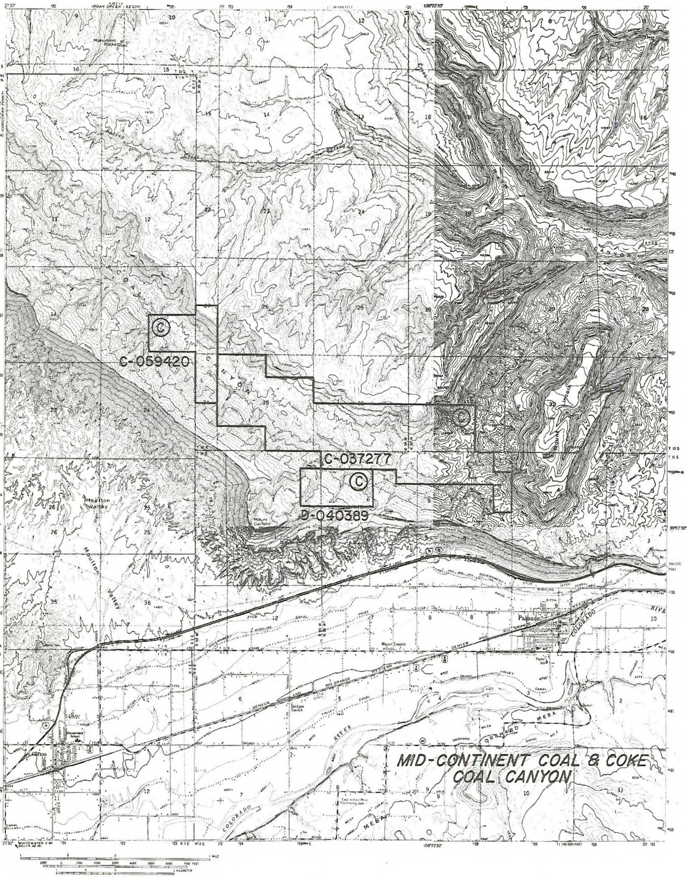
The coal to be mined from the Cameo coal bed would be used primarily as steam coal and would most likely be shipped by rail to out-of-state utility markets. Currently, no market has been established; however, negotiations indicate there are adequate markets.

History and Background

Production from the Little Bookcliffs area was first recorded in 1890. Several underground mines produced 900,422 tons from the Palisade seam through 1969, including the Mount Lincoln Mine, the Gearhart Mine, the Garfield Mine, the Palisade Mine, and the Riverside Mine. Most recently the Coal Canyon Strip Mine operated in 1963, 1968, and 1969, producing 69,152 tons by both strip and auger methods from the Cameo- Carbonera interval of the Palisade seam. The largest past producer was the Cameo No. 1 mine, which produced 4.2 million tons from 1899 to 1969.

Predisturbance Inventories and Analyses

The entire area of the Coal Canyon Mine lies within the proposed Little Bookcliffs Wild Horse Area. The U.S. Soil Conservation Service has mapped the mine area even though the area is outside of the Mesa County Soil Survey (in press). The Bureau of Land Management (BLM) has completed an endangered and threatened plant literature search and herbarium survey. Also, BLM performed a preliminary vegetation study in the fall of 1977 and will do a complete vegetative inventory during 1978. The Colorado Division of Wildlife has completed an inventory and study of the area for rare and endangered species. An archeological and



FEDERAL LEASE

© PUBLIC LAND SURFACE, FEDERAL MINERAL

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Map MA1-1. Mid-Continent Coal and Coke's Coal Canyon lease area

historical site survey is to be performed under the direction and cooperation of Mid-Continent Coal Company in consultation with BLM.

Stages of Implementation

Preparation for the mining project would begin in 1980, using a work force of 50 persons. Initial construction of the project is most likely to begin in 1983 using a work force of 50 employees. Initial coal production would be 100,000 tons with a work force of 125 persons in the second project year (1984). Production would increase to 200,000 tons for 1985, and the work force would increase to 200 employees. Full design production of 500,000 tons per year would be attained in 1989, and annual production would remain at that amount, with the work force remaining constant at approximately 200 employees. The company expects to obtain most of the labor force from the Grand Junction area and to train inexperienced people as necessary to meet the employment demand. The mine life is estimated at 15 to 25 years. (Map MA1-2 shows the mine layout. Figure MA1-1 is an aerial photograph of the proposed mine site.)

Mine Layout

The Coal Canyon property has been divided into two sections by Mid- Continent. The two areas are separated by a fault trending northeast in Section 36, T. 10S., R. 99W. The normal rotational fault, with downthrow to the east, has a displacement of approximately 40 feet at the outcrop, increasing to 95 feet where it crosses the northern boundary of the lease at 1,650 feet from the outcrop.

Two different mining methods are proposed for the two areas. The area east of the fault would be mined through four or five portal locations. Recovery would be based on a combination of longwall extraction, following development by continuous miners. The area west of the fault does not appear to be suitable for longwall techniques due to projected dip increases combined with the relatively small panels which it would be possible to develop. Limited access would restrict development of entries for longwall panels. Therefore, this area is planned for room- and-pillar extraction using continuous miners. A corridor has been reserved in each mine area for access to the coal located north of the present leases. Mining in the west section would commence after the area east of the fault was fully developed. Auger mining is proposed to recover coal from those areas along the outcrop which have cover too shallow for underground mining.

The development work in the mine would be four entry systems with entries 16 to 20 feet wide on 80-foot centers. Longwall and continuous miner development panels would be at intervals of 500 feet. Longwall panels would range from 2,000 to 3,600 feet in depth with a 500-foot mining face. Continuous miner room-and-pillar panels would range up to 2,000 feet long with rooms 20 feet wide and about 500 feet deep. The full height of the seam would be mined.

Roof support plans would be designed and submitted to the Mining Health Safety Administration (MSHA) for approval. Exact details would depend largely on early mining experience. Drill hole data show that there is geologic variation in the Cameo seam area; as a result, there may be roof control and bottom heaving problems. Conditions would be continually evaluated as mining proceeds. Normal safety and roof support procedures and details would be followed.

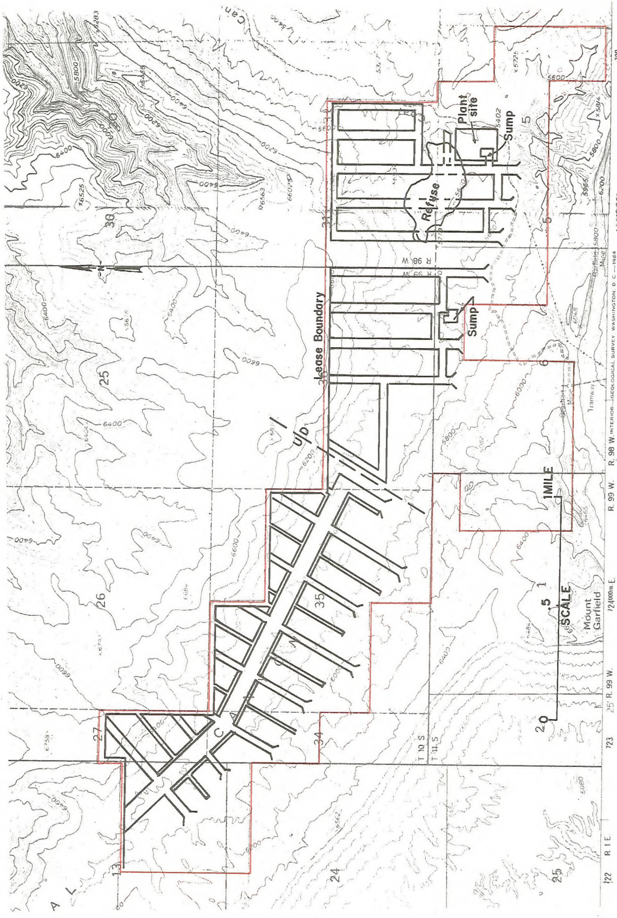
East of the Fault

Development mining would be done with continuous miners; secondary mining would be done by retreat of longwall panels. Areas in the southeast and northwest corners would be extracted by room-and-pillar methods using continuous miners (see map MA1-2). A significant area is believed to be burned out in the southwest corner of the block. This burned out area would be explored by continuous miners to define the extent of the burn.

Mining would be initiated in this area with development of the first west mains, followed by development of the 101 and 102 longwall panels. Longwall retreat mining would commence in the 101 panel and continue on sequence. Development would then proceed to the second west mains, then to the third west mains, and continue westward until the east area is completely developed. A corridor between the third and fourth west mains (map MA1-2) would allow future access to coal located north of the present leases. However, no plans have been developed for mining this coal since it is outside the lease boundary.

Depending on needed production balances, there probably would be two continuous miner sections and one longwall section at full production east of the fault. A continuous miner section would consist of a continuous miner, two shuttle cars (or continuous haulage belts), a feeder-breaker, a power center, and a roof-bolting machine. Coal haulage from the section to the portals would be by belt conveyor. Secondary mining would be by longwall methods and/or continuous miners generally using fully retreating methods.

Areas for auger mining along the outcrop are shown on map MA1-2. The coal along the outcrop is generally under low cover for several hundred feet, and auger mining would allow safe recovery of much of this coal. After auger mining, the coal face would be backfilled for safety and fire preven-



Map MA1-2. Mine layout for Mid-Continent's proposed Coal Canyon Mine

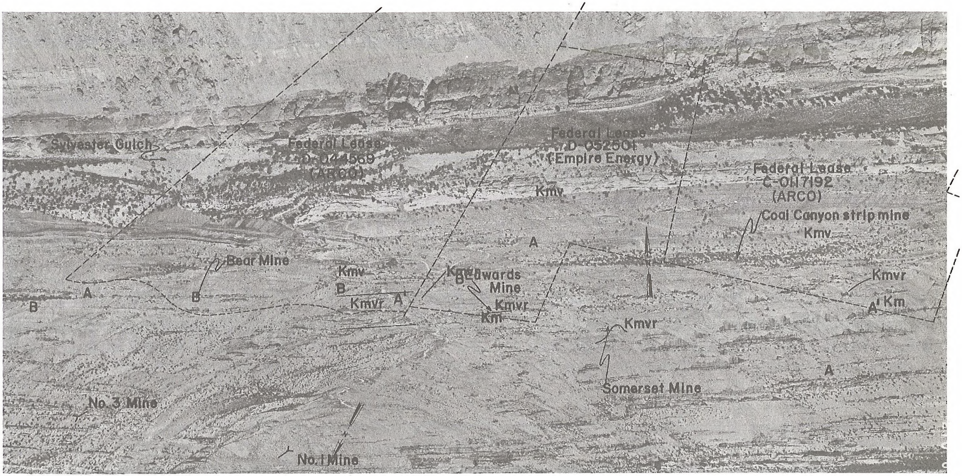


Figure MA1-1. Looking northeast from the Little Bookcliffs escarpment into Coal Canyon at the abandoned Coal Canyon Strip Mine and Mid-Continent Coal and Coke's proposed Coal Canyon Mine site. Mid-Continent proposes to construct facilities at point A and portals at each of the points marked B. Kmvr indicates the Rollins sandstone, the bottom member of the coal-bearing Mt. Garfield formation. The Cameo coal zone lies directly on top of the Rollins sandstone.

tion; complete outcrop covering would be done after mining.

WEST OF THE FAULT

Development mining would be by continuous miners west of the fault. Secondary mining would be by standard room-and-pillar methods using continuous miners. Longwall techniques do not appear feasible due to the projected steep dip of the seam combined with possible relatively small panels.

Access to this area would be limited because the outcrop is south of Coal Creek. Mine layout would be dictated by access and the increasingly steeper dip toward the west.

A corridor for future deep mining of coal north of the leased area is located just west of the fault. No plans have been developed for mining this coal.

VENTILATION

The mines would be ventilated by fans at each main exhaust portal as mining progresses toward the west. The fans would be axial exhaust type. Detailed ventilation plans would depend on several factors, some of which must be determined by actual mining. Ventilation plans would be approved by MSHA.

HAULAGE SYSTEM

Coal would be hauled from the sections to the portals by belt conveyors. The section belt-conveyors would be 36 inches wide with the main belt-conveyors being either 42 or 40 inches wide. Supply and personnel transportation in the mine would be by MSHA-approved electric and/or diesel powered equipment. The main supply system most likely would be by electric locomotive track haulage.

Surface Facilities

Approximately 99 acres would be required for surface facilities, which would include portal support structures, raw-coal storage facilities, preparation plant and dryer, loadout facilities, refuse disposal system, water supply system, power lines, and access roads.

SUPPORT STRUCTURES

A service area covering approximately 20 acres would be constructed in the northwest portion of Section 5. The facilities might include, but would not necessarily be limited to the following:

Offices
Shops
Parking lots
Bathhouse-locker
Lunchroom
Water storage
Waste-water disposal
Laboratory
Warehouse
Substations

Some facilities would also be required adjacent to the other mine portals in Coal Canyon. These facilities might include, but would not necessarily be limited to the following:

Offices
Parking lots
Coal bins
Portals
Hoist or trolley house
Fans

Exact locations, size, and design of such facilities would be dictated by numerous factors, but they would cover about 14 acres total in the portal areas. All facilities would be built to conform with all applicable government regulations existing at the time they are constructed.

Raw-coal storage bins would be located along the mine road adjacent to the portals. One bin would serve two portals. Surface conveyors would carry the raw coal from the mine portal to the bins, and trucks or conveyors would transport it to the preparation plant site.

Preparation Plant and Dryer

A proposed preparation plant and dryer unit covering approximately 7 acres would be constructed within the service area in the northwest portion of Section 5 near the east end of the property. The plant would be designed to handle in excess of 500,000 tons of coal per year. It would have standard sizing and washing equipment with a closed water loop, together with all normal and necessary safety and pollution control facilities. The plant would meet all applicable government codes and regulations existing at the time it is built. Two products would be discharged from the plant: (1) clean coal, which would be transported by truck to a rail loadout facility and (2) refuse, which would go to a disposal site.

Loadout Facilities

A clean-coal storage facility would be constructed adjacent to the preparation plant. It would include a clean-coal bin, a surgepile, feeders, a scale, etc., and would meet all applicable government codes and regulations existing at the time it is built. The clean coal would be transported by trucks to a unit-train loadout facility to be located north of the Cameo power plant. The unit train facility is being constructed by General Exploration Company.

1Refuse Disposal

Shale, bone coal, parting material, and similiar refuse would be removed from mine-run coal at the preparation plant. This refuse would probably amount to over 150,000 tons per year at planned mine capacity. It would be used at first as fill material to aid in development of the property and

then would be disposed of in a 47-acre disposal area in the northern part of Section 5, T. 11S., R. 98W., and the southern portion of Section 31, T. 10S., R. 98W.

Water Supply and Distribution

The preparation plant would require make-up water, the mines would require water for fire protection and dust control, and surface area dust control may require some water. Total water requirements are estimated at 36.8 acre-feet per year. It is estimated that 5 to 8 million gallons of water per year would be required for the preparation plant.

The system for nonpotable water storage and use would be supplied by water from the mines. It is estimated that 3 acre-feet of water to be purchased from local water utilities for domestic purposes or treated mine water may be used. If the mine has more water than could be used, water storage/evaporation ponds would be constructed so that there would be no objectionable discharge of mine water. Berms and dikes would be constructed, and surface facilities and the refuse disposal area would be designed so that any contaminated surface runoff that results from precipitation could be contained. This water would go to storage/evaporation ponds and could be used to supplement the nonpotable water system. Drainage and settling ponds would be maintained at all times to prevent discharge to natural drainage.

Power Lines

Power for the property would be supplied by Public Service Company of Colorado. A main substation would be built in the north portion of Section 5. Primary power lines would be constructed by the Public Service Company; secondary power lines would be constructed by Mid-Continent and would run from the main substation to the various facilities required on the site. The power system would meet all applicable government safety and design requirements existing at the time of construction.

Access Roads

The existing access road to the property follows Coal Canyon, originating near the Cameo power plant in Section 34, T. 10S., R. 98W. This road was used for hauling coal from the Coal Canyon strip mine and for access to the Gearhart and Garfield mines. The road is currently used as a power line maintenance road.

This existing road would be upgraded through Sections 27, 28, 29, 31, and 32, T. 10S., R. 98W., and into Section 5, T. 11S., R. 98W., a distance of about 4.3 miles. The road would be widened to about 20 to 25 feet and designed for 30- to 45-mile-per-hour traffic. It would have a heavy-duty gravel or crushed rock surface. Approximately 13 acres would be disturbed by upgrading the road which would require right-of-way agreements and/or permits from General Exploration Company, Colorado Fuel and Iron, and Public Service Company of Colorado. Exact details of construction and road location would be dictated by field conditions and permit requirements. Vehicular traffic to and from the mine sites would be primarily off-road coal-haul units, supply and equipment vehicles, and employees' personal vehicles.

To obtain access for the portals on the ledge forming the north wall of the canyon, Mid-Continent would build an access road along the coal outcrop line. This road would start at the existing main access road in the north-central part of Section 5 and continue westward as shown on map MA1-2. The disturbed area would be only wide enough to provide a 20- to 25-foot-wide roadway with adequate shoulder areas on both sides, and approximately 6 acres would be disturbed. The road surface probably would be heavy-duty gravel or crushed rock. Exact details of construction would be developed in cooperation with the Mesa County Commissioners. Vehicular traffic would be primarily coal trucks and vehicles carrying supplies and personnel to and from the mine portals. In addition, about 900 feet of the mine access road along the coal outcrop would lie in a portion of Section 6 that is outside the lease area. A right-of-way from BLM for this portion of the road would be required.

Portions of the Gearhart Mine road and an existing jeep trail in the canyon bottom should receive only minimal use by company personnel, and no improvements are anticipated.

Surface Reclamation

Since the proposed mine would be underground, surface disturbance should be minimal. Topsoil would be removed and stockpiled for future use. When the mine is abandoned, all portals would be sealed properly, and surface structures would be removed entirely, including concrete foundations. The portal area would be graded to approximately its original contour. The areas would be topsoiled and seeded with either native species or adapted domestic species. The refuse pile would be graded to match the surrounding terrain, topsoiled, and seeded properly. Roads and other disturbed areas would be reclaimed, topsoiled, and seeded.

Authorizing Actions

This M&R plan was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Section 502 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87). Therefore, this plan does not fully reflect the requirements of the initial regulations. Howev-

er, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan was designed using the requirements of the initial regulations. Before the plan is forwarded for approval by the Secretary of the Interior, it will be returned to the mining company for redesign to incorporate the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is governed by the regulation 30(CFR): 715.15. The standards and measures described in those regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

Federal Agencies

Before approval of the M&R plan is granted, BLM must concur with Mid-Continent's proposal following redesign according to 30(CFR): 211 and 30(CFR): 700 regulations and review by USGS and OSM. In addition, BLM must authorize a right-of-way for access road upgrading over public lands not leased by Mid-Continent.

USGS would with BLM concurrence approve the M&R plan.

OSM would review the M&R plan and, following redesign according to 30(CFR): 700 regulations, approve it along with USGS approval and BLM concurrence.

State and County Agencies

Air quality, solid-waste disposal, water quality, and mining and reclamation of mineral land must comply with rules and regulations administered by the various divisions within the Department of Natural Resources. Approval of the mining and reclamation plan, permits and licenses to mine coal must be obtained from the state of Colorado. Mid-Continent would also have to obtain rights to use any mine water in their operations from the State Engineer.

Mid-Continent would have to obtain a special-use permit from Mesa County and comply with stipulations given by the county.

Interelationships

Relationships to Other Existing and Proposed Developments

The Roadside Mine, operated by GEX-Colorado, a subsidiary of General Exploration Company (GEX) is the only active mine in the area of the proposed Coal Canyon Mine and is approximately 2.5 miles east. Annual production from the Roadside in 1977 was 300,200 tons of coal from both private and federal leases. The coal was trucked from the mine to the purchasers. GEX is also in the process of opening the Cameo No. 1 and No. 2 Mines, which are approximately 0.5 mile northwest of the Roadside. (See map 1 in appendix A.)

The Denver & Rio Grande Western Railroad (D&RGW) main line, which parallels Interstate 70 and the Colorado River in DeBeque Canyon, is approximately 2.5 miles by road east of the Mid-Continent operation. GEX is constructing a railroad loadout facility on the north side of the Colorado River which would be used by both GEX and Mid-Continent. The loadout facility would be a short spur off the main line of D&RGW in DeBeque Canyon. (Figure MA1-2 is a photograph of the Cameo loadout facilities.)

Housing and service facilities exist in the area in Palisade and in Grand Junction. Experienced labor is in short supply in the area because agriculture is the mainstay of the area.

Relationship to BLM Land Use Plans

The 2,020 acres of public lands included in this M&R plan are administered by the BLM's Grand Junction District. They are subject to the management guidelines that were developed in the Roan Creek-Uinta Flats management framework plan (MFP) completed in January 1971, and the Grand Junction Resource Area Coal Update MFP, completed in September 1977.

The surface overlying Mid-Continent's lease holdings has been used for livestock grazing in the past, but it is now included in the Little Bookcliffs Wild Horse Area and is devoted exclusively to grazing by wild horses and other wildlife. Some recreation use occurs in the form of four-wheel driving, viewing of the wild horses, and hunting. As pointed out in History and Background in chapter 1, coal was mined in Coal Canyon for a number of years.

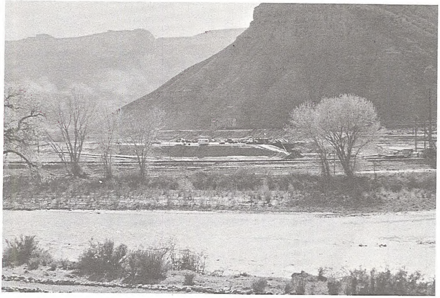


Figure MA1-2. The loadout facilities being constructed by General Exploration in the Cameo area would be used by Mid-Continent for the Coal Canyon and Cottonwood Creek mines, as well as by GEX for the Cameo mines.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, and cultural resources and the socioeconomic conditions which constitute the site-specific environment in which Mid-Continent Coal and Coke Company proposes to develop federal coal. The description focuses on environmental details most likely to be affected by Mid- Continent's proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunder storms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air movements.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Coal Canyon mine site is located north of the Colorado River near the mouth of DeBeque Canyon. Elevation at the site ranges between 5,200 and 6,800 feet. No meteorological measurements are made on site. Data from the Grand Junction weather station indicate that the average annual temperature is 53 degrees Fahrenheit, and annual precipitation is about 8 to 9 inches. The growing season is 188 days (based on 32-degree freeze threshold data). Evaporation is estimated to be about 45 inches annually.

Prevailing wind at this site is influenced by its location in Coal Canyon. No wind measurements are made on site. It has been assumed that prevailing wind direction is down valley or from the northeast. The wind rose from the nearby Grand Junction weather station has been rotated to reflect the major canyon axis, as shown in figure MA2-A. Average wind speed at the Grand Junction station is 8.1 miles per hour.

Air Quality

Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations range from 20 to 40 $\mu g/m^3$.

A detailed air quality analysis determined that particulate concentrations in the Grand Valley in areas away from any sources were approximately 40 $\mu g/m^3$ annual geometric mean (PEDCo 1977). The calculated first and second maximum 24-hour concentrations were 130 and 112 $\mu g/m^3$, respectively.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutant concentrations in the vicinity of the proposed mine. The Cameo power plant and motor vehicle emissions near the mine site probably raise concentrations of these pollutants slightly above background or natural levels.

Visibility at the site ranges from less than 1 mile to approximately 100 miles throughout the year. Average visibility is about 54 miles with greatest visibility occurring during spring and summer months.

Future air quality without the proposed Coal Canyon mine is expected to be nearly the same as current air quality, about 40 $\mu g/m^3$. There are an existing mine (Roadside) and a power plant, as well as two proposed mine sites (Cottonwood Creek and Cameo), within a few miles of Coal Canyon. Ambient air quality monitored close to the two existing sources is presumably measuring their impact--an annual geometric mean of 42 $\mu g/m^3$. Ambient concentrations may increase as a result of the new sources.

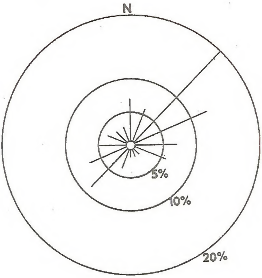


Figure MA2-A. Annual wind frequency at the Coal Canyon mine site

Geologic and Geographic Setting

Topography

The federal coal leases that compose the Coal Canyon mine property lie northeast of (or behind) the Little Bookcliffs escarpment. The entire property lies along the steep embankments that form Coal Canyon, a tributary of the Colorado River. Elevation varies from 5,280 along the bottom of Coal Canyon at the eastern boundary to 6,600 feet along the northern boundary. Mt. Garfield lies immediately south of the lease area along the Little Bookcliffs escarpment. It rises to 6,765 feet, forming a topographic high for the area.

Topographically, the area is quite rugged (see map A1-1 in chapter 1). The stream in Coal Canyon has become deeply entrenched through thick sedimentary strata. The entire mine property occupies the steep canyon walls which face either southwest or northeast except along the very eastern boundary of the lease area. The steep canyon walls are notched every few thousand feet by small ephemeral streams draining into Coal Canyon.

The maximum relief on the lease property is generally found along the northern canyon walls where slopes may reach up to 85 percent.

Geomorphology

The lease area lying south of Coal Creek is dominated by the dip slope of the Cozette sandstone (basal sandstone of the Iles formation) and, toward the west end of the properties, the dip slope of the Rollins sandstone. This slope dips to the northeast about 13 degrees and is cut by numerous ephemeral stream valleys. In the vicinity of the Gearhardt Mine portal, two very large blocks of Cozette sandstone have slumped or were faulted down, forming a secondary bench on the Little Bookcliffs escarpment.

To the north of Coal Creek, the Rollins sandstone forms a prominent bench, the bottom of which controls the course of Coal Creek throughout most of the property. Above the Rollins sandstone, the Cameo-Carbonera coal interval and related soft sediments of the Cameo member form a belt of relatively subdued topography from 0.25 to 0.5 mile in width. Above this zone, the more resistant sandstones of the Hunter Canyon member form a steep escarpment 600 to 1,000 feet above the coal-bearing strata.

Structure

Structurally the Coal Canyon area is fairly simple. The axis of a synclinal flexure superimposed on the Little Bookcliffs monocline roughly parallels Coal Creek and plunges to the east, with dips as great as 12 to 18 degrees on the south side diminishing to 3.7 degrees near the northeast corner of the properties. In addition, a normal rotational fault down to the east is present to the center of the lease area. Displacement at the outcrop is 40 feet, increasing to 95 feet along the lease boundary 1,650 feet from the outcrop. Another small normal fault, possibly related to cliff-face sloughing, is present in the underground workings of the Gearhardt Mine.

Stratigraphy

The stratigraphic formations which outcrop on the Coal Canyon property are restricted entirely to Upper Cretaceous sedimentary rocks and Pleistocene or recent colluvial and alluvial deposits. The Upper Cretaceous sedimentary series comprises the Mancos shale and the Mesaverde group, and coals of commercial quality in the Little Bookcliffs area are restricted to these two units. These formations and their coal-bearing units are described in ascending order.

The lowest and oldest formation on the property is the Mancos shale. The uppermost member of the Mancos, the Anchor Mine Tongue, occurs interbedded with the Sego sandstone, the lowest member of the Mesaverde group (see figure MA2-1). The Anchor coal seam, which occurs in the Anchor Mine Tongue, is not significant in this area.

The base of the Mesaverde group is at the bottom of the Sego sandstone. The group is divided into two formations: the Mt. Garfield formation and the overlying Hunter Canyon formation. The three coal-bearing zones are confined to the Mt. Garfield formation; in ascending order they are the Palisade, Cameo, and Carbonera seams (see figure MA2-1).

The Palisade seam varies from 3.67 to 7.83 feet in thickness and averages 5.99 feet. Erratic thicknesses and partings together with excessive overburden may preclude the mining of the Palisade seam in this area, and Mid-Continent does not propose to mine this seam at this time.

The Cameo coal seam is notable for the thickness of its seams and its great extent. It has been the most productive zone in the Little Bookcliffs coal field. One of the chief characteristics of the Cameo coal is the relatively large amount of bone coal whose ash content exceeds 50 percent. Another distinctive feature is the presence of sandstone dikes. These dikes vary from several inches to several feet in thickness and may intrude into all or only part of a seam. They occur wherever the Cameo is mined but appear to occur most frequently in the Mt. Lincoln area.

The Cameo has been divided into two benches, the A and B; where the coal benches come together, the seam is considered the Cameo B. In the Coal Canyon area, the Cameo B varies from 0.67 to 20.42 feet in thickness, averaging 9.11 feet. The Cameo A varies from 0.17 inches to 12.34 feet,

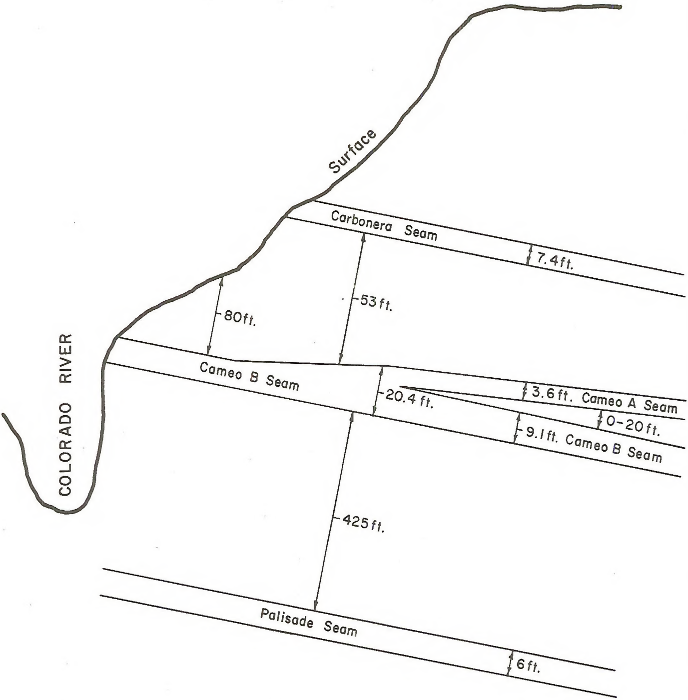


Figure MA2-1. Schematic of coal seams at the proposed Coal Canyon Mine

averaging 3.60 feet. The interval commonly contains one or more splits; partings are included in the thickness above. The split between the two seams varies from 0 to 20.17 feet thick.

The Carbonera coal seam overlies the Cameo at distances of 21 to 98 feet, averaging 53 feet. Throughout its extent, the Carbonera appears to be a series of detached coal seams and lenses rather than a distinctive bed, making correlation difficult. The Carbonera seam contains from one to ten beds and is commonly split by multiple partings. The Carbonera varies from 0 to 11.58 feet thick, averaging 3.5 feet. This average thickness together with the multiple partings precludes mining in the Carbonera in the Coal Canyon area.

Recent deposits consist primarily of large blocks of sandstone which have weathered, broken off cliff faces and ledges, and either slid or rolled down slope from their original position. These blocks range up to several tens of feet in largest dimensions. Sheet wash, made up mostly of small rock fragments, sand, and clay, makes up the base for generally poorly developed thin soils in the remainder of the area. Minor mud-flow deposition has occurred along the course of Coal Creek.

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be considered in the environmental statement (ES) process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table MA2-1. Due to the present lack of data and accepted criteria for determining significance, the importance of these paleontological resources to science, education, etc., cannot presently be assessed.

The BLM and U.S. Geological Survey (USGS) are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

Mineral Resources

Coal

A northeast trending fault divides the area of the proposed project into two sections. The area east of the fault would be mined by the retreating longwall method. The area west of the fault would be mined by the room-and-pillar method. Between 40 and 50 percent of the coal reserves of the Coal Canyon area would be recovered.

The Cameo seam outcrops in Coal Canyon, but has been burned back from the outcrop for variable distances up to 1,000 feet. The maximum overburden in the east block is about 1,200 feet, averaging about 500 feet. Overburden where the facilities and refuse pile are to be averages about 130 feet, varying from 80 feet to 200 feet. Maximum overburden in the next block is about 1,300 feet, averaging about 700 feet.

Table MA2-2 gives the proximate analyses and company reserve data of the coal seams under the proposed Coal Canyon project. (See the stratigraphy section of Geologic and Geographic Setting for further discussion of the coal seams.)

Oil and Gas

There is a slight potential for oil and gas under the leased area of the Coal Canyon project. In the near future, a well is to be spudded-in approximately 2.5 miles southeast of the leased area.

Water Resources

Surface Water

Coal Canyon is the only natural water course on the proposed lease area. Surface water flow in Coal Canyon is ephemeral, flowing less than one month each calendar year, usually after heavy summer thunderstorms which produce surface runoff. Coal Canyon drains an area of 11.7 square miles. The drainage area above the mine site is 7.7 square miles. A maximum flow of 3,440 cubic feet per second (cfs) was recorded by USGS on July 18, 1974.

Ground Water

No specific ground water data are available for the Coal Canyon area. However, the Rollins sandstone is located within the lower Mesaverde formation, and it is the source of many springs and wells. The ground water flow in this formation is controlled by interstitial porosity, that is, water is contained and transmitted through interconnected pore spaces between grains within the sedimentary bedrock. Water yields from the formation vary between 0 and 50 gallons per minute (gpm), but generally average 10 gpm.

TABLE MA2-1

SUMMARY OF FOSSIL-BEARING FORMATIONS
IN THE AREA OF THE PROPOSED COAL CANYON MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils b/
Mancos Shale	Upper Cretaceous	General	I, V
Mt. Garfield	Upper Cretaceous	General	I, V, P
Hunter Canyon	Upper Cretaceous	General	I, V, P

a/ General = Formation contains fossils throughout; specific localities are not identified.

b/ I = invertebrate; V = vertebrate; P = paleobotanical.

TABLE MA2-2

PROXIMATE ANALYSES OF COAL SEAMS IN PROPOSED COAL CANYON PROJECT

Bed	Acres	Average Thickness	In-Place Reserves (million tons)	Recoverable Reserves (million tons)	BTU	Sulfur (Percent)	Moisture (Percent)	Ash (Percent)	Fixed Carbon (Percent)	Volatile Matter (Percent)
Palisade	1,010	5.99	10.54	5.27	11,161	1.07	7.58	15.11	48.08	36.80
Cameo A		3.60	-	-		No Data Given				
Cameo B	1,000	9.11	15.87	7.36	10,244	0.92	7.68	19.71	44.43	35.85
Carbonera		3.5	-	-	10,426	0.87	7.16	20.12	43.84	36.05

Water Quality

There are no available water quality data for Coal Canyon because of the infrequency of flow. However, when runoff water flows through these ephemeral drainages in response to summer thunderstorms, the water level rises and falls rapidly, termed 'flash flooding.' As these flash floods move down the channel, they first scour and then fill the channel bottom, and then leave flood deposits on the valley floor after they recede. The resultant quality of these flash flood waters can be classified as very poor with suspended sediment loads typically in the tens of thousands parts per million.

The quality of ground water in the Mesaverde group can generally be expected to be of poor quality. Analysis of water throughout this aquifer show that excessive iron, manganese, sulfate, and flouride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1973, Price and Arnow 1974, and Brogdon and Giles 1977). Typically the water is of poor chemical quality for domestic or public uses.

Flood Hazard

Coal Canyon Mine and facilities lie within a dry canyon with a drainage area of approximately 7.7 square miles. Using a modification of the Department of Agriculture method for predicting flood discharge rates, the discharge from a 100-year/6-hour storm, with a precipitation rate of 3 inches per hour, was estimated at 3,978 cfs (figure MA2-2). Flood flows averaging 3,440 cfs have been recorded in Coal Canyon by the Soil Conservation Service.

Soils

The entire area of proposed mine surface activity is contained within a single soil mapping unit. This unit consists mostly of rock outcrops on very steep slopes intermingled with generally stony or gravelly soils. Landslide areas and small pockets of shallow and very shallow soils are also included. Specific soil features of importance in assessing reclamation are rated in table MA2-3; brief explanations of each rating are contained in the footnotes.

Vegetation

The coal lease tract is divided into two broad vegetation types: saltbush and pinyon-juniper. (See map MA2-1.) The saltbush type covers 67 percent of the lease area, amounting to 1,354 acres. It is dominated by shadscale and galleta grass. Mormon tea, four-wing saltbush, sagebrush, Indian ricegrass, and ryegrass are locally abundant within the saltbush type.

The pinyon-juniper type covers 33 percent of the lease tract (667 acres) and is dominated by Utah juniper. Understory is sparse, consisting of Indian ricegrass, western wheatgrass, galleta grass, bottlebrush squirreltail, cheatgrass, and various forbs. Big sagebrush and rabbitbrush are scattered within the pinyon-juniper type.

The separation between the saltbush and pinyon-juniper types is maintained by a distinct rainshadow effect, with the south slopes being dryer because of a higher evapotranspiration rate than the north exposures. The saltbush type can tolerate lower moisture levels than pinyon-juniper and consequently inhabits the south slopes, while pinyon-juniper is on the north slopes.

Small stands of greasewood occur sporadically on the lower drainages within the lease area, mainly along Coal Creek. In addition, some of the very steep, southern exposures are almost totally devoid of vegetation, due to the extreme dryness. No data are available on aquatic vegetation in the area proposed for mining.

A more detailed discussion of the plant species composition of the vegetation types mentioned, as well as their relationship to climatic and topographic features and to each other may be found in the regional analysis. Scientific names of the plants are listed in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the *Federal Register* (see table R2-10 in the regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State University, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Coal Canyon Mine. The results of the literature and herbarium studies may be seen at the BLM Montrose District Office. A detailed floristic and endangered and threatened plant inventory of the natural vegetation that is expected to be disturbed by the Coal Canyon mine facilities and roads has revealed that no endangered or threatened plants are present. The results of this inventory are available for public review at the Grand Junction District Office.

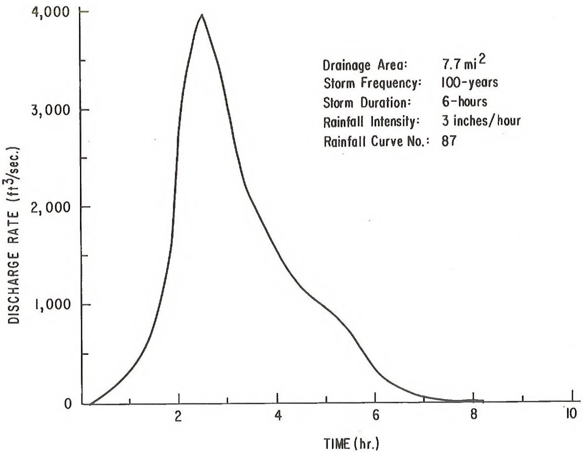


Figure MA2-2. Hydrograph of the runoff in Coal Canyon from a 100-year/ 6-hour event

TABLE MA2-3

SOIL FEATURES FOR MID-CONTINENT: COAL CANYON MINING AREA

Mapping Unit Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
Rock Outcrop				
Rock Component	-	-	-	-
Deep Stony Component	B	Moderate	Poor	Severe
Shallow Component	D	High	Poor	Severe

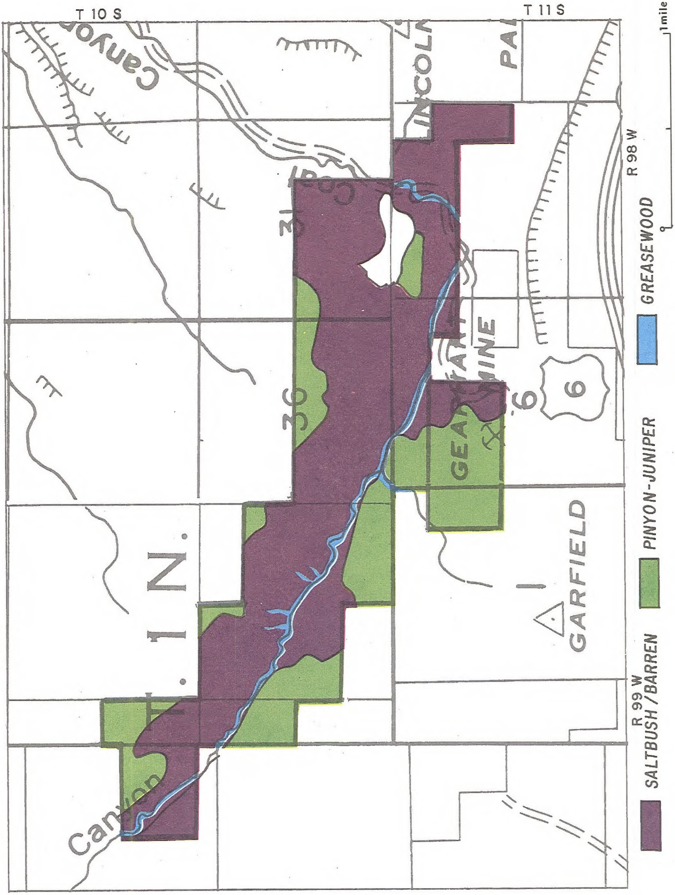
Note: Adapted from U.S. Dept. of Agriculture, Soil Conservation Service (Grand Junction, Colo.), Mesa County Area Soil Survey (unpublished).

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic and soil conditions which produce extreme surface erosion or landslide hazards.



Map MA2-1. Vegetative types in the area of the proposed Coal Canyon Mine

Wildlife

All terrestrial species known or expected to occur in the Coal Canyon area are listed in appendix C.

Wild Horses

The Little Bookcliffs Wild Horse area is shown on map MA2-2. The area was established in 1974 by a general management agreement. Formal designation of the area as a wild horse range by the Secretary of the Interior is being considered. A management objective is to maintain the area in a relatively natural state and minimize harassment of horses.

The current population is approximately 70 horses, following the removal of 40 horses in the fall of 1977. The annual increase is about 20 percent and the population can build rapidly. Coal Canyon is primarily winter range; in the summer, horses move to the north where water and feed are more plentiful. In 1975-76, 45 horses wintered in the Coal Canyon drainage, primarily using the south-facing slopes where snow does not accumulate. This winter population is expected to drop now that 40 horses have been removed, but horses will still winter in Coal Canyon because of their habitual use of the area and the suitability of topography. During the summer, there is no water in Coal Canyon, and the area therefore gets summer and early fall rest from horse use. The current forage production for horses in the Coal Canyon area is 25 acres per animal unit month (AUM).

Big Game

MULE DEER

Coal Canyon is on the lower extreme of the Roan Creek deer herd's winter range. Based on pellet group transect, 1.17 deer days of use per acre occur in the lower half of Coal Canyon. Deer normally move into this area in mid-November and remain until April, when they gradually migrate north to higher elevations. (See map MA2-3.)

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average numbers. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer population within the Coal Canyon lease area of about 150 animals during the winter months.

MOUNTAIN LION

Coal Canyon offers the kind of rough canyon land and isolated habitat found within the Little Bookcliffs, which supports a good population of lions. If mountain lions occupy Coal Canyon, their greatest period of use would be winter, when mule deer and horses move into the area.

Small Mammals

Species composition is typical of the pinyon-juniper, sagebrush, and saltbush habitats in western Colorado. Cottontail rabbits, chipmunks, mice, and rock squirrels are some of the more common species. Small mammals closely associated with aquatic habitat, such as beaver, muskrat, and raccoon, occur along the Colorado River. There is no aquatic or riparian habitat in Còal Canyon. Coyote, bobcat, and ringtail cat are predatory species found in Coal Canyon.

Game Birds

Mourning doves are the most common game birds found throughout the Coal Canyon area. During the summer, doves nest throughout the area, utilizing trees or the ground as nest sites. They concentrate around weed patches, road shoulders, and small seeps or stock ponds.

Chukars, an introduced species, are found throughout the canyon. Steep rocky slopes and cheatgrass (*Bromus tectorum*) are important habitat components for this species. Three guzzlers (watering devices) have been installed in Coal Canyon to improve summer water distribution for chukars and other small mammals and birds.

Mallards and Canadian geese nest and raise their young along the Colorado River in DeBeque Canyon. During spring and fall migration and the winter months, a much greater variety of waterfowl is present on the river, with the common merganser and common goldeneye two of the most abundant species.

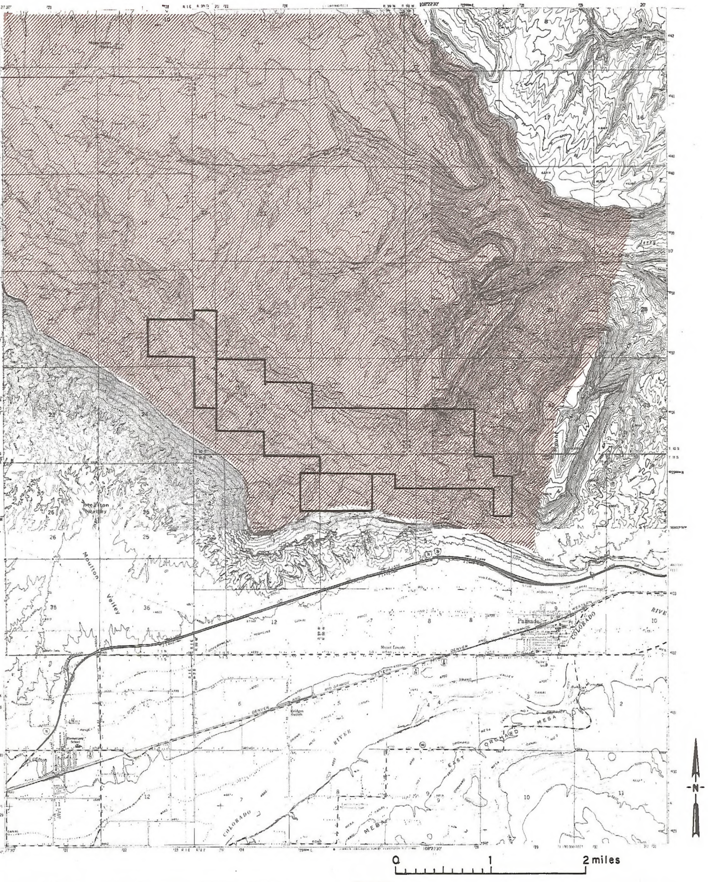
Other Birds

Currently no raptor species have been located in the Coal Canyon area. The abundance of cliff faces and the height of the canyon walls provide excellent potential nesting habitat for golden eagles, prairie falcons, and redtailed hawks. These species do nest outside Coal Canyon, and they would be expected to spend time hunting within the Coal Canyon drainage as the area is within normal hunting limits of known aerie sites.

The greatest variety of songbirds occurs in the riparian zone along the Colorado River. Species would be more limited in the pinyon-juniper and saltbush habitat within Coal Canyon; pinyon jay, honed lark, chipping sparrow, and whitethroated swift would be some of the more common summer residents.

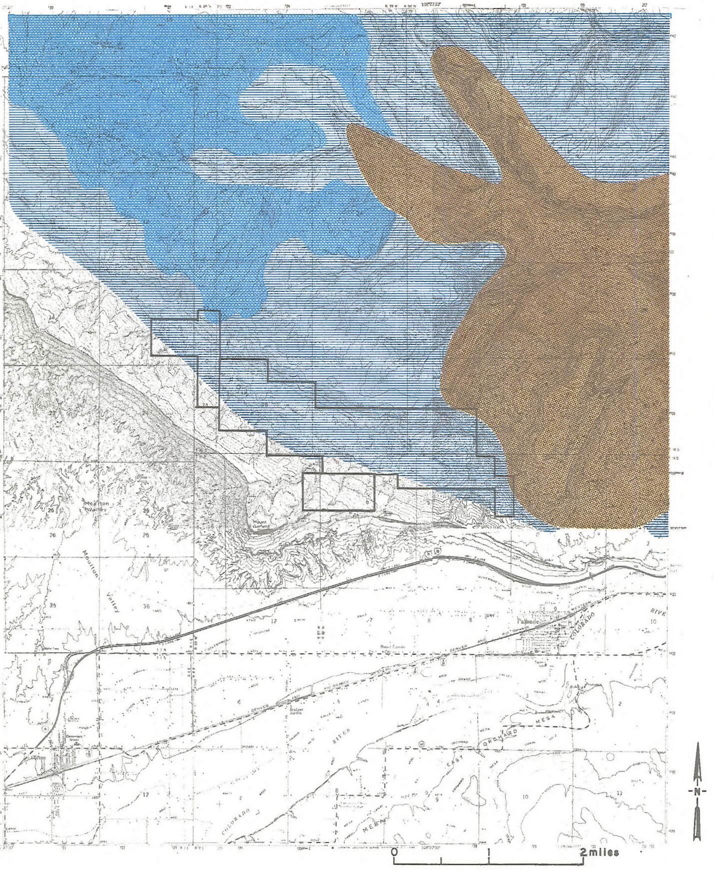
Endangered or Threatened Species

Within the nearby DeBeque Canyon area, an active peregrine falcon aerie was discovered in July 1977 (Enderson 1977). The aerie will have to be observed for one or more years to determine whether the falcons will continue to use this nest-



Map MA2-2. Little Bookcliffs Wild Horse Area

LITTLE BOOKCLIFFS WILD HORSE AREA AND RESOURCE STUDY AREA



Map MA2-3. Wildlife ranges in the area of the proposed Coal Canyon Mine: deer, endangered species

MULE DEER WINTER RANGE

MULE DEER WINTER CRUCIAL RANGE

ENDANGERED SPECIES (Peregrine Falcon)

ing cliff or possibly a complex of cliffs in the general area.

Peregrines are not able to tolerate a high level of temporary human activity within 0.25 mile of their nest, particularly between March 1 and August 1, or a high level of permanent human activity within 0.5 mile of nest sites (Gerald Craig 1978, personal communication). The Colorado River and areas adjacent to riparian habitats are suspected to be important hunting areas because of the abundance of peregrine prey in this area. Habitat in this type is being destroyed by changing land use, particularly on-going coal development. (See map MA2-3.)

Bald eagles are commonly seen along the Colorado River in DeBeque Canyon throughout the winter months. Birds are frequently observed on hunting forays along the river or perched in cottonwood trees.

Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle.

Aquatic Biology

Coal Canyon is the major drainage on the lease site. The stream is intermittent and does not support any aquatic habitat. It is characterized by rapid, heavy runoff for short periods during precipitation events. Runoff water is typically high in sulfates, carbonates, total dissolved solids, and suspended sediments.

The lease site is adjacent to the Colorado River, and all site drainage enters directly into the river. The Colorado River at this location is considered a warm-water fishery. Channel catfish, large mouth bass, sunfish, and bullheads dominate the game fish population, while numerous nongame fish species including roundtail chub, sand shiner, carp, flannelmouth sucker, bluehead sucker, speckled dace, redfin shiner, carp and others are found here.

Endangered or Threatened Species

From below the confluence of Plateau Creek, this section of the Colorado River is habitat for three species of threatened and endangered fish. The Colorado squawfish, the razorback sucker, and the humpback chub are presently known to exist in the river directly adjacent to the mine area. The U.S. Fish and Wildlife Service has recommended this section of river as critical habitat for the Colorado squawfish (see Aquatic Biology, chapter 2, regional analysis).

Cultural Resources

Archeological Resources

No inventory has been completed for the Coal Canyon site, although a Class III survey is required prior to approval of the proposed action. Areas undergoing surface disturbance are contained within a saltbush/barren vegetation zone (see map MA2-1, which shows vegetation types in the Canyon site). As part of the regional predictability model (see appendix D), archeological inventory in saltbush dominated zones suggests a probable site density of 1.3 sites per section (Hibbets 1978). Although site density is expected to be low, no conclusive statement can be made until the predictability model is completed; the final report is due December 15, 1978. Archeological values, indicating prehistoric use, have been identified in the surrounding area (see chapter 2 of the regional volume for description of the archeology).

Historical Resources

No formal inventory has been conducted on the Coal Canyon site, although one is planned. There are two small mines on this site which produced from 1930 until the 1960s. These mines were among the last developed in the region and as such are not historically significant.

Transportation

Highways

Interstate 70 is the major highway nearest to the proposed Coal Canyon mine. At present the highway is operating below capacity in the Cameo area. U.S. Highway 6 also serves the same area but goes through the towns rather than around them.

Railroads

The Denver and Rio Grande Western Railroad main line lies parallel to I-70 in the vicinity of the Coal Canyon property. This is a major rail line that connects Denver and Salt Lake City and serves many of the coal areas in Colorado and Utah.

Airports

Walker Field near Grand Junction is the major airport in the ES area and the largest airport in western Colorado. It is served daily by Frontier and United airlines.

Livestock

The entire coal lease tract is part of the Little Bookcliffs Wild Horse Area, and no livestock are grazed on it.

Recreation

The Coal Canyon lease site lies almost entirely within the Little Bookcliffs Wild Horse Area (see map MA2-2). The BLM's Grand Junction Resource Area Coal Update MFP (completed in September 1977) recommends that the area be managed as a wildland study area until its potential for wilderness status has been evaluated. (For wildland study area management guidelines, refer to appendix J.) Access to the wild horse area is limited to two nonmaintained roads, one of which passes through Coal Canyon and the lease area.

Although there are no recreational facilities in the proposed mining area, the lease site provides hunting opportunities for game, such as mule deer and chukar. Coal Canyon Creek is an intermittent stream and offers little recreational value. (Refer to Wildlife and Aquatic Biology in this chapter for the extent of the resources.) The lease site is located within Big Game Management Unit 30, which provided 3,364 recreation days in 1976, and Small Game Management Unit 58, which provided 35,723 recreation days in 1975. (Tables MA2-4 and MA2-5 list hunter days by species and game management units.)

The Colorado Division of Parks and Outdoor Recreation manages the Island Acres Recreation Area, which is located on the Colorado River about 1 mile upstream from Mid-Continent's proposed coal train loading facility. Island Acres provides opportunities for camping, picnicking, and swimming. The area provided recreation for 102,578 visitors in 1977.

The majority of the population increase due to mining activity would occur in the Grand Junction-Palisade area. Grand Junction provides city-sponsored leagues for softball, basketball, and volleyball. Facilities in the Grand Junction area include eleven parks, fourteen swimming pools, and sixteen tennis courts. The Grand Junction Recreation Department feels that use of its facilities is now maximum; people have to be turned away from the programs, especially league activities. The department also states that only 40 percent of this use is from city residents, which indicates that the city's programs are a major recreational outlet for the surrounding area. The city of Palisade provides a park with playground, two tennis courts, and a basketball court.

For a comprehensive look at the recreational resources of the region, refer to chapter 2 of the Regional Analysis, Recreation.

Visual Resources

Coal Canyon is a dry, highly eroded, V-shaped drainage (see figure MA2-3). Its rock walls tower 1,200 feet over the bed of the intermittent stream, with the eastern slope forming the base of Mt. Lincoln. Layered rock strata form exposed cliff faces and taluses which support sparse vegetative communities. Dark coal layers are intermixed with stratified rock in the lower levels of the exposed wall and further emphasize the horizontal, linear nature of the canyon landform.

The light tans of the rock strata are the dominant colors in the canyon, but the sidewalls, exposed erosional cuts, and jagged cliffs generate a diverse pattern of shadows. Vegetation colors are muted except for scattered gray-green junipers which grow randomly in the canyon. The combination of grass tufts, mountain brush, and junipers creates a spotty texture over the terraced landforms.

A single-lane dirt road runs along the bottom of the canyon, serving as an access road, formerly for old mines and now for a single-pole transmission line. Some terraces have been graded and leveled at scattered points, but the canyon landscape is primarily natural.

Coal Canyon has a VRM Class II rating (see appendix F for VRM methodology), which requires that visual changes in the canyon should not be evident in the landscape. The visual dominance of the cliffs is the primary reason for the Scenic Quality Class 'B' rating which represents a strong scenic potential for the public.

Coal Canyon's inclusion in a wildland study area (Little Bookcliffs Wild Horse Range) puts it under the control of interim management guidelines (appendix J) which supplement the Class II management objectives. No irreversible changes in the landscape are to be allowed, and disturbed areas are to be returned to their original state.

Socioeconomic Conditions

Demography

Table MA2-6 lists the population for each incorporated town and each county census area within Mesa County and western Garfield County, for the 1970 and 1977 censuses. Grand Junction and vicinity is the most heavily populated community between the Denver and Salt Lake City metropolitan areas. As such, it serves as a regional center of commercial and industrial activity for most of western Colorado and eastern Utah. Recent growth in the Grand Junction area has been caused by a variety of economic factors, including the expectation that the area's mineral resources will develop rapidly in the near future. Corporations and government agencies involved in mineral resource development over a wide area have located regional headquarters in Grand Junction. Table MA2-6 indicates that most areas around Grand Junction have grown at a moderate rate, averaging between 3 and 5 percent per year since 1970.

TABLE MA2-4

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 30

	Deer	Elk	Bear	Mountain Lion	Total
Hunters	854	-	20	9	a/
Recreation days b/	3,122	-	151	91	3,364

Source: Colorado Division of Wildlife, 1976 Colorado Big Game Harvest.

a/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

b/ All or part of a day.

TABLE MA2-5

SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 58

Animal	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	1,166	9,794	Badgers	9	757
Geese	423	1,950	Beavers	17	426
Doves and pigeons	1,106	6,251	Bobcats	30	1,918
Pheasants	2,021	7,203	Ringtailed cats	3	310
Chukars	500	1,123	Coyotes	21	2,086
Grouses	261	814	Foxes	29	1,235
Ptarmigans	7	0	Muskrats	32	1,203
Rabbits	3,952	28,789	Raccoons	20	509
Squirrels	53	225	Skunks	7	144
Foxes	38	72			
Coyotes	386	4,529			
Marmots	98	299			
Prairie dogs	550	4,140			
Magpies	352	5,283			
Total	b/	70,472		b/	8,588

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals are not included because hunting and trapping of more than one species are allowed.

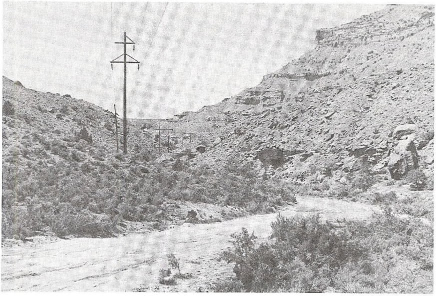


Figure MA2-3. The sidewalls of Coal Canyon create a "U"-shaped landform.

The median age of the population in Mesa County is higher, but not significantly higher, than the Colorado median age of 26.2 years. The Palisade area has a relatively older population than the rest of the county, and a much higher concentration of persons over 65 years of age.

The small communities of DeBeque, Collbran, and Grand Valley are similar in size, and all contain a population whose median age is higher than the Colorado median. Collbran is somewhat different from most communities in western Colorado in that the median age of its population increased between 1970 and 1977. The DeBeque and Grand Valley areas have experienced growth due to the location of the Occidential Oil Shale test site outside of DeBeque and the Paraho Oil Shale site east of Grand Valley.

Community Attitudes and Lifestyles

According to the Mesa County Development Department, a majority of the new residents in the Grand Junction area moved there because they liked it as a place to live. The Grand Junction area is more urban than most other areas of western Colorado, but it is still small enough to retain attributes of small town living. Residents place a high value on the casual atmosphere and lack of congestion associated with life in Grand Junction. However, there is also a desire to attract economic growth to the area and improve job opportunities for residents.

As a population center, Grand Junction provides its residents opportunities not available in most other communities in western Colorado. Mesa College offers courses of study in many subject areas, college athletic events, and dramatic performances. There is a larger selection of stores, restaurants, and movie theatres than in other towns. Airline and bus service to metropolitan areas is regularly available, and an interstate highway links Grand Junction to Denver and Salt Lake City.

Community attitudes towards growth and development were documented in a survey conducted by Bickert, Browne, and Coddington and Associates, Inc., in July 1973. Results of that survey are discussed in the regional volume.

Community Facilities

Most of the developed areas around Grand Junction receive water from the Ute Water Conservancy District which provides water to other districts and to individuals. The district is currently developing additional water resources. There are many special districts in the county providing various services including water, sewer, fire protection, pest control, hospital services, cemetary services, and flood control. There are two sanitary land fills in the county. Police services outside of town is provided by the county sheriff.

Grand Junction, Fruita, Collbran, Palisade, and DeBeque are improving or plan to improve their water and sewage treatment systems. More detailed information about facilities in the county is included in the regional volume.

Housing

Table MA2-7 lists the housing units available in Mesa County and western Garfield County, according to the 1977 special population censuses. The total housing stock in Garfield County increased by 22 percent between 1970 and 1976. About 40 percent of that increase was mobile homes.

The Colorado Division of Housing (1976) estimates that there was a total of 24,914 housing units in Mesa County in April 1976, an increase of 6,116 units (or 32 percent) from 1970. Over one-third of the total increase in housing stock was mobile home units. In recent years, duplexes and multifamily units have constituted about 30 percent of the new housing starts. High prices for single-family dwellings and the unavailability of rental units are contributing to an increase in multifamily and mobile home units throughout the county. The county has an above average need for low to moderate income housing, because (1) the median family income is more than $3,000 less than the state median and (2) Mesa County has an above average number of elderly persons.

Education

Education in the areas around the Coal Canyon mine is provided by four public school districts: Mesa County Valley School District 51, DeBeque School District RE49 (JT), Plateau Valley School District 50, and Grand Valley School District 16. Mesa County Valley is by far the largest with 96 percent of the combined enrollment. In general, the school districts all have some excess capacity to absorb new students. Mesa County Valley has some problem with capacity of its junior high schools but plans to expand in the future. Table MA2-8 summarizes the situations of the four districts.

Health Care

The level of health care services in and around Grand Junction is the highest in the ES area. The four hospitals located in Grand Junction provide specialized services to much of western Colorado. In addition, the Fruita area is served by a small hospital located in town. There are more physicians located in Grand Junction than in the remainder of the ES area combined. Many of these physicians are specialists, who provide their services to patients from a wide area. Ambulance services to the area are good; both Fruita and Grand Junction operate ambulance services connected with their

fire departments. Mental health services are provided to the area by the Colorado West Regional Mental Health Center, which is headquartered at Glenwood Springs but has offices in Grand Junction. The Mesa County Department of Public Health has a staff of six public health nurses who provide generalized health eduction and preventative health services in addition to specialized activities in tuberculosis control, mental retardation, venereal disease, and handicapped children's programs.

Health care in eastern Mesa County is limited. Collbran supports the Plateau Valley Hospital and Nursing Home. The hospital has six beds, three of which conform to federal standards. The nursing home has thirteen long-term care beds. A single doctor provides most of the service to patients in the Collbran area.

DeBeque and Grand Valley have no health care facilities in town. The nearest doctor for DeBeque residents is in Palisade, 22 miles away, and hospital care is available in Grand Junction. The closest physicians and hospital for Grand Valley residents are in Rifle, about 16 miles away.

Employment

In Mesa County, where most of Coal Canyon's employees would live, employment grew at an annual rate of 6.1 percent between 1973 and 1976. The total number of persons employed increased from 24,030 to 28,622 during this period. As shown in table MA2-9 the increase was all in nonagricultural employment; agricultural employment declined by 11.6 percent. A comparison of employment by sector shows that all sectors showed some growth, but the mining, the transportation, the finance, insurance, and real estate, and the contract construction sectors had the largest percentage increases. The increase of 130 percent in mining employment can be attributed to new mining activity in the Uravan uranium belt and coal mining in western Garfield County. Oil shale test projects near DeBeque and Grand Valley have also added to employment in the mining sector. In terms of number of employees, the service trade and mining sectors showed the greatest increase.

Table MA2-9 also shows that the trade, service, and government sectors are the largest employers in the Mesa County economy and that, in spite of the fast growth rate, the finance, insurance, and real estate sector and the mining sector are the smallest. The sectors with the largest employment in Garfield County are also trade, services, and government. Almost all sectors have grown since 1970.

The regional volume gives more detail about employment in Mesa and Garfield counties. Employment data for specific towns and cities are not available.

Income

The proposed Coal Canyon property is located in Mesa County, 2.5 miles east of the town of Palisade. According to the U. S. Department of Commerce (1974), 1974 per capita income in Palisade was $4,324. This was substantially below the county average of $4,799, which in turn was lower than the Colorado average of $4,514. Mesa county ranked fourth in the seven-county ES area.

Median family income in Mesa County was estimated to be $11,130, third highest in the region but lower than state and national averages. In 1975, 11.4 percent of the families in the county had incomes below the poverty level.

In 1974, government (21.0 percent) and wholesale and retail trade (20.6 percent) were the largest sources of personal income. Other sectors and the share they produced were services, 15.7 percent; contract construction, 10.2 percent; transportation, communication, and public utilities, 9.9 percent; manufacturing, 8.9 percent; agriculture, 6.9 percent; finance, insurance, and real estate, 3.6 percent; mining, 3.3 percent; and other industries, 0.4 percent. This breakdown indicates the importance of the trade sector in the economy of the county and the role of Grand Junction as a regional center. For a discussion of regional incomes, see the income section in the regional volume.

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describe the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceeding section of chapter 2 which are expected to change in the future: air quality, vegetation, wildlife, archeological resources, recreation, and socioeconomic conditions.

Air Quality

Future air quality without the proposed Coal Canyon mine is expected to be nearly the same as current air quality, about 40 $\mu g/m^3$. There are an existing mine (Roadside) and a power plant, as well as two proposed mine sites (Cottonwood Creek and Cameo), within a few miles of Coal Canyon. Ambient air quality monitored close to the two existing sources is presumably measuring their impact--an annual geometric mean of 42 $\mu g/m^3$. Ambient concentrations may increase as a result of the new sources.

TABLE MA2-6

POPULATION STATISTICS

	1970 Population	1977 Population	Percent Change 1970-1977	Median Age-1970 (Years)	Median Age-1977 (Years)	Percent Population Over 65 Years
Mesa County:	54,374	66,848	+ 23	30.2	29.4	+ 11
Clifton area	3,554	5,913	+ 66	30.2	26.8	+ 9
Fruita	1,822	2,328	+ 28	34.1	28.5	+ 15
Fruita area	5,837	7,709	+ 32	29.4	28.4	+ 10
Grand Junction	24,043	25,398	+ 5	32.1	30.2	+ 15
Grand Junction area	28,527	35,871	+ 26	30.0	29.3	+ 13
Orchard Mesa area	6,890	5,012	- 27	28.6	29.6	+ 8
Palisade	874	1,038	+ 19	-	46.9	+ 31
Palisade area	1,964	2,178	+ 10	41.8	38.8	+ 21
Redlands area	4,446	6,826	+ 53	29.9	30.6	+ 6
Whitewater area	605	751	+ 24	36.1	32.6	+ 12
Collbran	225	293	+ 30	-	36.9	+ 20
Collbran area	1,428	1,364	- 4	31.4	33.6	+ 14
DeBeque	155	264	+ 70	-	32.5	+ 14
DeBeque area	306	427	+ 40	42.1	33.5	+ 14
Garfield County:						
Grand Valley	270	377	+ 40	-	30.0	+ 18
Grand Valley area	819	858	+ 5	32.1	30.9	+ 14

Source: U.S. Bureau of the Census, 1970 Population Census and 1977 Special Census for Mesa and Garfield Counties.

TABLE MA2-7

EXISTING HOUSING IN PROPOSED ACTION AREA

County	Total Housing Units	
	Occupied	Vacant
Mesa County:		
Collbran	119	13
DeBeque	100	11
Fruita	788	41
Grand Junction	10,129	596
Palisade	418	23
Unincorporated areas	12,321	759
Garfield County:		
Grand Valley	138	19

Source: U. S. Bureau of the Census, Special Population Censuses for Mesa and Garfield Counties, 1977.

TABLE MA2-8

CHARACTERISTICS OF AFFECTED SCHOOL DISTRICTS

School District	1977 Enrollment	Schools	Design Capacity	Excess Capacity	Teachers	Student: Teacher Ratio	Bonding Capacity (dollars)	Outstanding Debt (dollars)
Mesa County Valley (51)	14,025	30	15,561	1,536	678	20:1	32,043,730	2,500,000
DeBeque (RE49(JT))	160	2	195	35	16	11:1	260,000	130,000
Plateau Valley (50)	284	3	350	66	14	20:1	1,200,000	19,000
Grand Valley (16)	180	1	250	70	17	10:1	800,000	184,000

TABLE MA2-9

GROWTH OF EMPLOYMENT BY SECTOR
IN MESA COUNTY, 1973-1976

Sector	1973	1976	Increase	Percent Change
Agriculture	3,030	1,790	- 240	- 11.8
Mining	390	900	+ 510	+ 130.8
Contract Construction	1,330	1,730	+ 400	+ 30.1
Manufacturing	2,280	2,440	+ 160	+ 7.0
Transportation	1,420	1,680	+ 460	+ 32.4
Wholesale and Retail Trade	5,040	5,710	+ 670	+ 13.3
Finance, Insurance, and Real Estate	630	820	+ 190	+ 30.2
Service	3,420	4,410	+ 990	+ 28.9
Government	4,140	4,470	+ 330	+ 8.0

Source: Colorado Division of Employment, Research and Analysis, February 1977.

Note: This information does not include self-employed workers, other than in agriculture, unpaid family, and domestic workers.

Vegetation

The vegetative condition of the coal lease tract, which at present is unsatisfactory with a downward trend, may improve in the future. The coal lease tract is part of the 26,268-acre Little Bookcliffs Wild Horse Area. The wild horse herd was reduced to 70 head in the fall of 1977 in order to alleviate the severe overgrazing of the range. The long-term effects of this herd decrease will be an increase in the desireable forage plants on the lease tract, namely western wheatgrass, Indian ricegrass, and galleta grass.

Wildlife

The management plan for the Little Bookcliffs Wild Horse Area proposes to maintain the herd within the carrying capacity of the area, which would keep use at an acceptable level. This area is also covered by the Roan Creek Habitat Management Plan, and its objective for mule deer is to increase the herd to where the average utilization on sagebrush (*Artemisia*) would be 40 percent and then maintain the herd at that level. All other wildlife uses would be about the same as present.

Archeological Resources

Through the year 1990, vandalism and erosion would be the two major factors causing the loss of archeological values. It is doubtful that additional monies or employees would be available to retard this loss, although the Federal Land Policy and Management Act of 1976 will provide BLM with more protective enforcement authority. The downward trend is expected to continue or accelerate under the present land use management program.

Recreation

The proposed U.S. Bureau of Reclamation (USBR) Dominguez Dam, just south of Grand Junction (see figure MA2-4) would provide water-based recreation such as boating, fishing, and swimming. The USBR estimates that the dam would provide 300,000 to 500,000 recreation days in its first year of use, which would help to relieve some of the projected need for this type of recreation identified by the 1976 Colorado Comprehensive Outdoor Recreation Plan (see regional analysis, chapter 2, Recreation).

The Little Bookcliffs Wild Horse Area may be classified as a wilderness area, which would then restrict travel and recreation on that area to non-motorized means.

Growth in Mesa County would increase by 34,700 people from 1977 to 1990 which would require 114 acres of additional community active/improved park land (e.g., ballfields, playgrounds, tennis courts) to prevent overuse and deterioration of existing facilities (Bickert, Browne, Coddington, and Associates, Inc., 1977).

Socioeconomic Conditions

Population of Mesa County is expected to grow at a rapid rate to 110,700 people in 1990. Development of oil shale and uranium and the area's role as a regional center account for the growth. The Grand Junction area will become more urbanized, resulting in the continued decline in the importance of agriculture in the local economy. Incomes are expected to be higher.

Garfield County is projected to grow at a rapid rate to 45,238 people in 1990, primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale development.

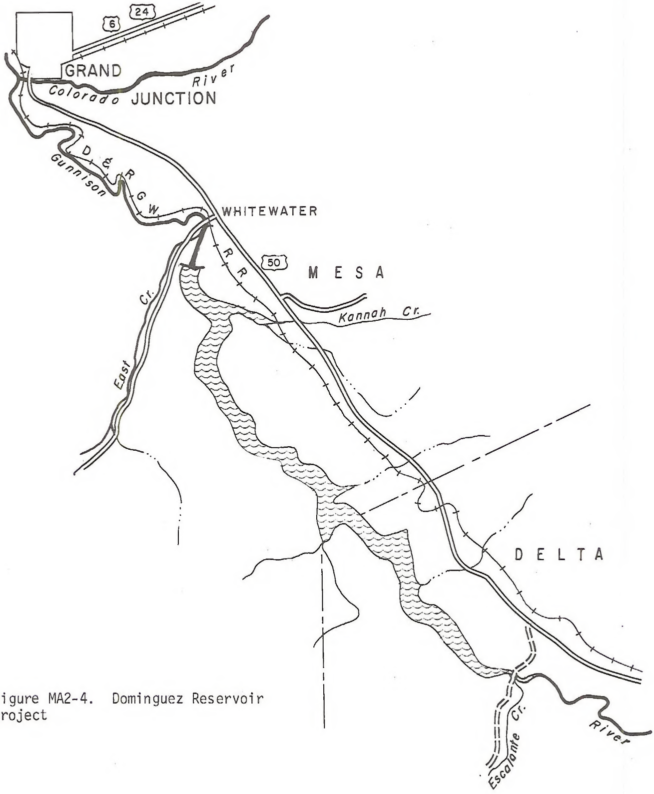


Figure MA2-4. Dominguez Reservoir project

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), and it does not fully reflect the requirements of the initial regulations. However, in this environmental statement (ES) the applicable initial regulations, which are considered as required federal mitigating measures, are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial regulations. The Department of the Interior will not approve the M&R plan until Mid-Continent Coal and Coke Company has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Coal Canyon mine include conveyors, transfer points, truck loadout of coal, open storage piles, haul roads, access roads, and wind erosion of refuse piles and other exposed areas at the mine. A common source of fugitive dust at underground mines not projected for the Coal Canyon mine is crushing and sizing, which should produce negligible emissions because a wet process will be used.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution- producing operation, (2) multiply that activity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Coal Canyon mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division and a recent study of emissions from mining (Colorado APCD 1978, Axetell 1978).

Table MA3-A presents estimates of fugitive dust emissions at the Coal Canyon site from each of the identified sources in 1985, 1990, and 2004 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The stimates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table MA3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Coal Canyon site other than fugitive dust sources were exhaust emissions from diesel-powered haul trucks and employees' motor vehicles on mine access roads. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table MA3-B. These emissions are based upon rates per mile of travel (emission factors) which will decrease between 1985 and subsequent study years. In the case of Coal Canyon, the reduced emission rates partially offset increased activity rates projected when the mine is at full production in 1990.

These emissions are from both employee travel on the mine site and haul trucks.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the canyon or valley near where mining emissions occur. The site specific meteorological data reflected the prevalence of transport of the pollutants up and down the canyon from the mine. Because of the greater influence of the canyon on maximum concentrations near the mine, a separate model which considers reflection of the plume was used to predict maximum 24-hour concentrations. This short-term model is described in the following section.

The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of Sixteen wind directions, six wind speeds, and six stability classes. Predicted concentrations are usually accurate within a factor of three.

Since there are no wind data available for the Coal Canyon area (see chapter 2), the wind and stability data required for the model were obtained by modifying that from Grand Junction airport to reflect orientation of Coal Canyon. This wind rose was previously shown in figure MA2- A. Emission data were presented in table MA3-A.

Predicted increases in ambient concentrations resulting from Coal Canyon's operation in 1990 are shown in map MA3-A; map MA3-B shows cumulative concentrations. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 3 micrograms per cubic meter ($\mu g/m^3$) in only a small area on the mine site near the preparation plant, refuse pile, and haul road; concentrations are predicted to increase by 1 $\mu g/m^3$ for a distance of about 0.5 mile east to west and 1.75 miles north to south from the surface facilities. Predicted impacts in 1985 are slightly lower but are shown to occur in these same areas. Based on these concentrations, it is not anticipated that the emissions would cause significant increases in annual average concentrations outside the canyon area.

The predicted impact of the mine is much less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. It is also much less than the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD), although coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

The dispersion model used to predict maximum 24-hour particulate concentrations assumed Gaussian distribution of particulates away from the plume centerline, a constant wind direction, and complete reflection of the plume off both canyon walls. The basic dispersion equation is described in detail in *Workbook of Atmospheric Dispersion Estimates* (Turner 1970). The fallout function was not incorporated in the short- term model.

Several locations (receptors) up and down Coal Canyon from the mine were specified in the model for prediction of ground-level concentrations. At each receptor, the contribution caused by each emission source at Coal Canyon was calculated separately; individual source contributions were summed to determine the total concentration at the receptor resulting from the mining operations.

Wind data from the Mt. Logan-Mt. Callahan reach of DeBeque Canyon, which has nearly the same orientation as Coal Canyon near the mine, indicated that winds blew from the south-southwest, or up canyon, for all 24 hours on five different days in one year and from the north-northeast, or down canyon, on two entire days. These time periods were assumed to produce the highest concentrations since downwind receptors would be in the plume continuously. From these 24-hour periods, the two days (one with south winds and one with north winds) with the lowest average wind speeds and most stable atmospheric conditions provided the meteorological input for modeling.

The annual average emission rates from the CDM model were also used to predict maximum concentrations because no information was available on seasonal variations in production. Although it is expected that emission rates will vary somewhat throughout the year, the sources at Coal Canyon mine are not subject to great increases in emissions due to equipment malfunction or high wind speeds. Also, increased emissions at different

sources would occur independently rather than simultaneously and would probably not occur at the same time as the most adverse meteorological conditions.

Predicted maximum 24-hour concentrations from the mine in 1990 are shown on map MA3-C. With winds from the north, a maximum concentration of 33 $\mu g/m^3$ is projected to occur directly east of the preparation plant. At the south end of the canyon, concentrations on the worst day would be about 24 $\mu g/m^3$. With winds from the south, the maximum concentration is predicted to be 25 $\mu g/m^3$ 0.8 mile up the canyon and 10 $\mu g/m^3$ 2.5 miles up the canyon. These concentrations are considerably less than the 24-hour primary air quality standard of 260 $\mu g/m^3$ and the secondary standard of 150 $\mu g/m^3$, and they are projected to occur only in the immediate vicinity of the mine. Maximum concentrations in 1985 would be about half this magnitude.

Because the short-term dispersion model involves prediction of extreme conditions for meteorology and emission rates, it is probably slightly less accurate than the annual model.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine will reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west-central Colorado has been empirically determined by Ettinger and Royer (1972); it is shown in figure MA3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due to precipitation. Therefore, the equation is more likely to predict visual range over an averaging period of a year than for a short-term period such as 24 hours.

As indicated on map MA3-A, particulate concentrations in 1990 would be increased to a distance of 0.5 to 2 miles from the surface facilities. Along a line of sight down Coal Canyon, concentrations would be increased an average of about 3.0 $\mu g/m^3$. Using the equation above and a background particulate concentration of 40 $\mu g/m^3$, the estimated reduction in visual range on the mine site as a result of mining emissions would be about 2 miles on an annual basis. Because of the limited area of air quality impact, average visibility would not be affected significantly off-site. Visibility reductions in 1985 would be even less than in 1990.

Geologic and Geographic Setting

Topography

Impacts of the proposed action on the topography of the mine property would be extensive. Three aspects of the mining operation would produce some alteration of the existing surface topography: excavation and earthmoving in preparation for construction of surface facilities; long-term use of the refuse disposal site; and surface subsidence.

Excavation and earthmoving associated with construction of surface facilities would cause minor alterations of the existing topography of the mine property. Approximately 99 acres, or 5 percent, of the mine property would be altered as roads, mine facilities, and the refuse disposal site are constructed. The majority of the change would occur in preparation for the mine offices, bathhouses, warehouses, refuse disposal area, etc. Existing slopes in the area average 25 percent (or 15 degrees). Benching, grading, and leveling would be required. In addition, blasting and cliff sealing may be necessary. Level surface and cut-and-fill structures would replace the steep natural slopes for the 15- to 25-year mine life. The modified surfaces created would alter the drainage characteristics of the area, increasing erosion and runoff. In addition, noise and vibration would add to the landslide and rockslide potential of the area. (See Soils for further discussion.)

Use of the refuse disposal area would gradually alter the existing topography of 47 acres (or 2 percent) of mine property over the 15- to 25-year mine life. (Note: these 47 acres are included in the 99 acres above). No detailed information concerning the refuse disposal site or its projected final topography was provided. It is only possible at this time to say that the existing topography would be smoothed and the elevation of the downhill portion would be raised.

A much more significant impact of the proposed mining operation would be surface subsidence. Three mining methods have been proposed for the mine property: retreating longwall mining; conventional room-and-pillar by continuous mining; auger mining. The magnitude, extent, and duration of the predicted subsidence depend on the mining method used as well as many dimensional and geologic factors.

Auger mining is proposed for mining of approximately 40 acres of the mine property. All of the areas to be auger mined are located along the coal outcrop as shown on map MA1-2. Presumably, auger mining is proposed in the outcrop areas in order to recover additional coal reserves which could not be recovered by underground mining

TABLE MA3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED COAL CANYON MINE SITE

Emission source	Emissions, ton/yr 1985	Emissions, ton/yr 1990 & EML
Conveyor - 4 sections	3.8	9.4
Transfer points - 3 points	8.4	21.1
Preparation plant - wet process	neg	neg
Truck loadout	neg	0.1
Open storage - surge pile	6.8	6.8
Haul roads - clean coal	74.8	187.0
- refuse	0.1	0.3
Access roads	73.2	73.2
Exposed areas - refuse	9.0	9.0
- rail/mine facilities	4.8	4.8
TOTAL	180.9	311.7

TABLE MA3-B

EMISSIONS OF GASEOUS POLLUTANTS FROM THE PROPOSED COAL CANYON MINE SITE

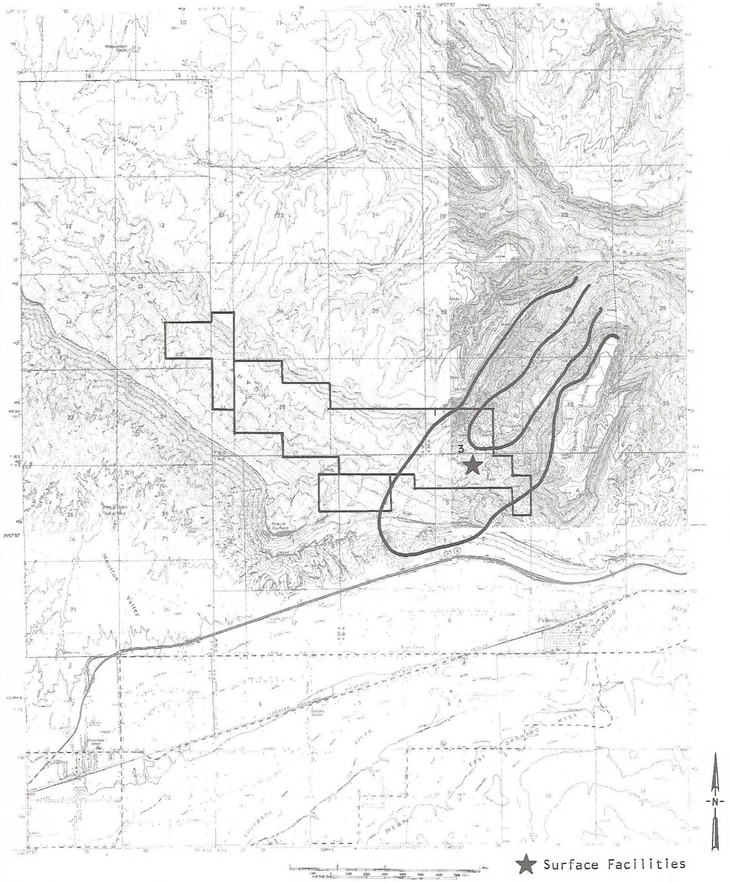
Year	Total emissions from vehicles, ton/yr			
	CO	HC	NO_x	SO_x
1985	7.0	0.7	1.6	0.3
1990	6.0	0.6	1.6	0.6

$$L_v = \frac{24}{0.2 + 0.007\,M}$$, where

L_v = Average visual range, miles

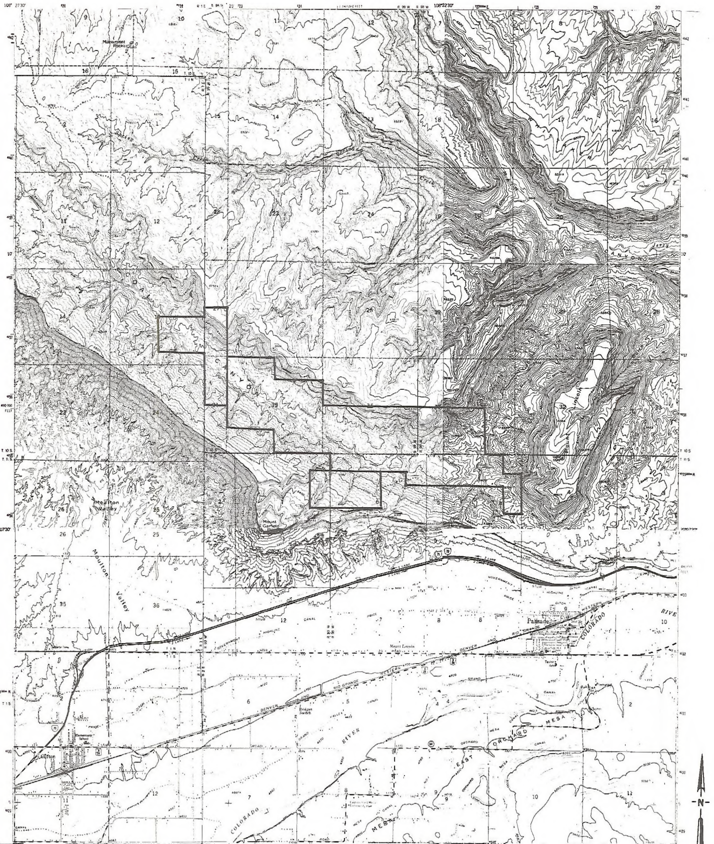
M = Average particulate concentration (micrograms per cubic meter)

Figure MA3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).



Map MA3-A. Predicted increases in ambient concentrations in 1990 (micrograms per cubic meter)

Map MA3-B. Cumulative concentrations from proposed actions in the Coal Canyon-DeBeque Canyon area (micrograms per cubic meter)



Surface Facilities

Map MA3-C. Predicted maximum 24-hour concentrations in 1990 (micrograms per cubic meter)

because of poor roof conditions along the outcrop. Underground recovery near outcrops would result in high extraction costs and poor recovery, whereas augering would recover coal effectively and at lower cost. However, because of the shallow overburden, extensive surface subsidence would occur over mined areas. In addition to subsidence, twisting and rotation of blocks of the surface would occur as they settle. Large open fractures and broken surfaces would probably occur. Erosion in the area would increase, water courses could change, and subsequent use of the area would be severely restricted.

Conventional room-and-pillar mining methods are proposed for more than 800 acres of the mine property. Overburden varies from 0 at the outcrop to approximately 1,300 feet at the northern boundary of the area. Subsidence occurring over areas which have been mined by room-and-pillar methods is difficult to predict because the pattern of openings and pillars makes rock movements complex. However, subsidence in the area can be predicted to be a maximum of approximately 8 feet, under 'worst case' conditions. The duration and extent of the surface subsidence are impossible to predict.

Finally, longwall mining on retreat is proposed for less than 200 acres of the mine property. The *Subsidence Engineer's Handbook* was used to predict a maximum of 8 feet of subsidence in the area. This maximum subsidence could occur over a large portion of the 200 acres. Because the mining would occur at shallow depths throughout most of this area, large open fractures, step-like areas, and cave-ins could occur above mined areas. Rupturing, collapse, rotation, and twisting of the surface could occur on large areas. (See Soils.)

An area of particular vulnerability is the refuse disposal site in Section 31, T. 10S, R. 98W., 6th P.M. The entire area would be undermined by longwall mining methods. Overburden in the area is shallow, and the maximum subsidence would occur over most of the 47 acres occupied by the site. If only vertical subsidence occurred, impacts to the site could be limited to disrupting established drainage by decreasing the drainage slope. However, twisting and rotation of surface blocks during settling could result in pollution and erosion hazards. Fires could begin if air is able to circulate through the refuse because of fracturing and collapse of the underlying surface. Fires in refuse disposal areas are difficult to suppress and may continue smoldering for long periods. Air quality in the area may be severely affected. In addition, the nearby surface water and ground water could be polluted by percolation of runoff through open fractures following collapse or rupture of the underlying surface.

Extensive surface subsidence would promote landslide and rockslide potential in the area. Water courses and ground water levels could be altered, and soil erosion, gullying, and sedimentation could be increased.

Finally, subsidence induced by mining could increase air circulation at depth through fracturing, allowing spontaneous combustion of the coal beds. In addition to causing a loss of the coal resource, burning of the coal bed reduces the volume of coal and thereby may induce more subsidence above the seam.

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased vandalism and unauthorized fossil collecting as a result of increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above impacts, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to the present lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the Bureau of Land Management (BLM) - U.S. Geological Survey (USGS) memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

Coal

The mining of an estimated 7.36 million tons of coal from the proposed Coal Canyon project over an estimated twenty-year period would result in the depletion of a nonrenewable energy resource. The coal is expected to be exported out of the area to utility plants for production of electrical energy.

The underground mining of the coal seams by the proposed mining methods would recover approximately 50 percent of the coal reserves. These are the most efficient methods of mining the leased

coal. Coal in the Cameo A seam, up to 12.34 feet thick, must be considered as lost in this analysis as a result of mining coal in the Cameo B seam. The difference between the two seams, up to 20.17 feet, is too thin to allow design of a mine plan to recover the A seam.

Oil and Gas

If oil and gas are discovered under the leased area, a settlement between well owners and the owners of the leased coal would have to be reached as to which nonrenewable energy resource would be produced first.

Water Resources

Surface Water

There would be no direct impact on surface water because of the arid environmental condition within the area. However, a secondary impact of increased demand on municipal water would occur. Population increases of 200 people by 1980, 810 people by 1985, and 920 people by 1990 have been projected for Mesa County. Also, increases in Garfield County of 60 people by 1980, 240 people by 1985, and 270 people by 1990 have been projected. Increased demands for municipal water are expected to be 78, 318, and 360 acre-feet per year for Mesa County and 24, 94, and 105 acre-feet per year for Garfield County by 1980, 1985, and 1990 respectively. Most of this pressure would be in Palisade and Grand Valley. Some of this new demand on municipal water would be fulfilled from ground water (domestic wells). However, the number of people who would elect to live in the county where municipal water is not available cannot be determined.

Ground Water

Mid-Continent hopes to obtain 27 acre-feet per year of ground water from the Coal Canyon mine to support the mining operation. This consumptive use is not a significant loss to the ground water supply of the Little Bookcliffs area. However, no water rights for this water have been granted to Mid-Continent Coal and Coke Company by the state of Colorado. Under Colorado state law, any beneficial use of ground water (dust control, washing coal, etc.) requires a well permit or a water right.

Water Quality

A decrease in surface runoff would reduce the quantity of suspended and dissolved solids. The decrease would not be measurable in the Colorado River and would thus be insignificant to the entire drainage basin.

Flood Hazard

There is no detailed information on the location of the facilities associated with the mining operation. If they are located in the bottom of the drainage, there would be a hazard to life and property. USGS has recorded a flood within this drainage. A storm that produced 1.38 inches of precipitation in Grand Junction, Colorado, on July 18, 1974, caused average flows of about 3,440 cubic feet per second (cfs) through Coal Canyon. Flood flows from a 10-year/24-hour storm would produce in excess of 5,200 cfs of water.

Soils

Soil impacts would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban area expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 8 feet (see Topography). Soil impacts would be minimal where no breaks occurred in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

The construction and operation of surface facilities would affect 0 acres by 1980 and 99 acres by 1985 with no further change through 1990. Erosion rates would increase in response to surface disturbance. An estimated 2- to 3-fold increase could occur in the already high natural erosion rate. Within the design limitations of the proposed action, most of this erosion would be contained onsite by drainage systems and other sediment control measures. However, these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology section). Over the 25-year minelife, there is a 93 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration in soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable at present, would further complicate inherent revegetation problems of low natural moisture, poor topsoil, and often steep terrain. These problems would prolong the efforts necessary to achieve successful reclamation (see Vegetation).

Off-site disturbances due to mine-related population increases would amount to 22 acres by 1980, 89 acres by 1985, and 101 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come from croplands in Mesa County. To this extent,

crop production capacity would be permanently lost. Soil erosion could initially increase from two to three times the natural rate, then gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

Approximately 99 acres would be disturbed by the proposed mine portals and associated facilities for the life of the mine, beginning by 1985 and extending through 1990. The bulk of this disturbance would be in the saltbush type, although a small amount of the greasewood type may be disturbed by the improvement of the road in Coal Canyon. The impacts of the disturbance would be to reduce the visual aesthetics of the area, increase soil erosion, and reduce the numbers of wildlife in the area (discussed in the appropriate sections).

Mid-Continent would be required to revegetate the 99 acres of disturbance at the Coal Canyon mine site upon abandonment of the mine. Specific revegetation measures that would be required by the federal coal mining regulations are stated in 30 (CFR): 717.20, and 30 (CFR): 211.40, 211.41, and 211.62, in the *Federal Register* (Vol. 42, No. 239, and Vol. 41, No. 96). These regulations cover the operator's (Mid-Continent's) responsibility and length of liability for revegetation 30(CFR): 211.40(a)(13)(i) states that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vegetation, shall be established on regraded and other affected lands.'

Problems may be encountered in attempting to revegetate the disturbed areas (such as steep south-facing slopes, low annual precipitation, high soil salinity, weed infestation), which may prolong the period of time required for successful revegetation. In such cases a five-year extension of Mid-Continent's responsibility for revegetation efforts may be necessary, beyond the five year period initially established by the government-authorizing officer responsible for monitoring revegetation at the Cottonwood Creek mine site, as (discussed in 30 (CFR): part 211.50 (a)(13)(ii).

Urban expansion caused by population increase related to coal mining would result in the disturbance of an estimated 23 acres of vegetation by 1980, 95 acres by 1985, and 107 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers; the capacity of these lands to produce crops would be permanently lost.

Increased numbers of people in the area would result in additional disturbance of native vegetation, particularly by off-road-vehicle use. This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos Shale hills and in alpine areas above timberline.

Wildlife

A total of 99 acres of wildlife habitat would be lost due to the construction of mine portals, facilities, and the disposal area by 1985, and this would be the extent of the disturbance through 1990. Small mammal and reptile populations would be destroyed, and the larger, mobile species of mammals and birds would move off the area.

Wild horses and mule deer winter throughout Coal Canyon, and it is one of the two areas that horses from the Little Bookcliffs herd are forced into by severe winter snows. If water is impounded in the canyon and is available to the horses, they could stay in the canyon for a longer period of time and use winter forage in the summer. Forage would be reduced, thus eventually decreasing the number of horses that the area could support. The probable reduction in mule deer populations is given in table MA3-1 along with the probable reduction in wild horse use.

Increased human and mechanical activity along the road and around mine portals and the plant site would also influence animal use for a distance of 1 mile from these areas. This impact would amount to an average of 50 percent reduced use on approximately 4,000 acres (see table MA3-1), assuming that mule deer, wild horses, mountain lion, bobcats, and coyotes are species which would be affected.

It is difficult to predict to what extent subsidence would affect wildlife because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Secondarily, individual animals could be frightened by humans in the area (mine workers, sightseers, etc.) and driven into the subsidence area where they could be injured or killed by the sharp changes in topography. To some extent, however, wildlife would gradually develop trails through the areas, which would lessen the danger for wildlife.

In Coal Canyon the 8 feet of subsidence (worst case) would occur on the south and southwest-facing slopes where the horses winter. With room-and-pillar mining, subsidence could occur for many years after the mine is abandoned. The horses would probably not use the area until the land had settled, and even then, because of the large drop that could occur, they still would not use the area to the fullest.

The eastern 2 miles of access road would be within the wild horse area and the mule deer winter range. Occasional collisions with horses or deer could occur.

TABLE MA3-1

IMPACTS ON WILDLIFE

Year	Total Disturbed Acres	Number of Animals that These Acres Could Support					Additional Acres Disturbed	Additional Animals that Could be Supported		
		DDA	D	EDA	E	WH		D 50%	E 50%	WH 50%
1977	0	1.17	0	-	-	0	-	-	-	-
1980	0	1.17	0	-	-	0	-	-	-	-
1985	99	1.17	1	-	-	2	4,000	14	-	16
1990	99	1.17	1	-	-	2	4,000	14	-	16

Note: DDA = deer days per acre; EDA = elk days per acre; D = deer; E = elk; WH = wild horses.

A system of power lines to various surface and underground facilities would be an electrocution hazard to the larger raptors, such as golden or bald eagles, red-tailed hawks, and great horned owls, if the lines are not properly designed. In addition, they would be a physical hazard to flying birds.

Species associated with the riparian vegetation type could decrease if the present loading facilities are expanded. The habitat adjoining the present facilities is becoming saturated with species that were occupying areas that have been stripped of their vegetation. If more area is cleared, then more animals would be forced into smaller areas; density-dependent limiting factors could then begin to cause some animal deaths and stress to all species. The losses are very difficult to quantify, primarily because of the lack of information on just how large a population triggers these density-dependent factors. It is well documented, however, that as density increases, reproduction decreases, causing a decline in the total population over time.

Secondary impacts from the proposed action would include increased human population, resulting in expansion of urban areas onto agricultural lands and some crucial winter range; increased vehicular traffic, resulting in an increase in vehicle/animal collisions; and increased recreational use of the area, causing an additional stress on the animals and increasing legal and illegal harvest of animals. This illegal kill could increase 10 times or 1,000 percent over current estimates (Al Whitaker 1978, personal communication).

Endangered or Threatened Species

It is possible that in the vicinity of the Colorado River, truck traffic and unit train loading facilities would disrupt hunting activities for two endangered raptors, the bald eagle and the peregrine falcon. The site for the loading facilities, on private land, has already been cleared of its vegetative cover, eliminating most of its value to raptors. Further clearance or disturbance in the riparian type adjacent to the Colorado River could further diminish the amount and quality of hunting areas for these two species, since the prey for both species is generally found in riparian or aquatic habitats.

Aquatic Biology

Endangered or Threatened Species

Specific details of planned water and drainage systems and refuse disposal areas are not given in the mining plan. No discharge of water from the mining operation is presently planned. However, according to the mining plan, if surplus water is produced, it would be discharged into surface drainages. If these discharges are of poor physical or chemical quality, they must be made to comply with 30(CFR): 717.17 water quality regulations, which may require extensive treatment of the water before discharge. If this section of the river receives designation as critical habitat for the Colorado squawfish by the Secretary of the Interior, then any action taken on a federal coal lease which would diminish the value of the Colorado River as aquatic habitat would be in direct conflict with Section 7 of the Endangered Species Act of 1973. In no case would any change in the water chemistry of the Colorado River be consistent with federal law.

Sediment retention ponds and a refuse disposal pile pose potential threats to aquatic life in the Colorado River. Specific designs of these facilities are not given in the mining plan. Proper location and construction of these facilities is essential to assure that failure or washout will not occur during a flood. Breaching of a settling pond would release materials into surface drainages which could cause the extinction of several threatened and endangered fish species in the adjacent Colorado River.

Cultural Resources

Archeological Resources

While no archeological values have as yet been identified in the Coal Canyon area, archeological sites in the adjacent areas indicate the presence of prehistoric inhabitants. A total of 99 acres (by 1985 and through 1990) would undergo surface and subsurface disturbance, which could result in the destruction or damage of unidentified archeological values. The possibility of subsidence occurring on 1,040 acres of the mine property could result in the displacement and damage of existing archeological sites. Alteration of the surface, whether in the form of slumping and bulging or fractures and twisting would create an impact on archeological values.

Controlled access into the lease area should keep vandalism within the site-specific area at a minimal level, although the presence of 50 mine workers by 1980, increasing to 200 mine workers by 1985 (and on through 1990) would increase exposure of existing archeological values to public passage (refer to chapter 4, regional volume for further discussion).

Prior to the approval of the proposed action, a concurrence of approval could be developed by the BLM with Mid-Continent to provide for the protection of cultural values. This could include provisions for work stoppage and compliance with Section 106 (National Historic Preservation Act, amended 1976) should archeological values be identified during mining and construction activities. In addition, should subsidence monitoring reveal areas of surface subsidence, provisions for a Class III survey in the impact area should be arranged in order to minimize the potential damage to archeological sites.

Historical Resources

Because the extent of historic sites in the mine area is not fully known, the following impacts may occur. Surface disturbing activities, such as mining or construction of facilities and roads, could disturb buried sites or destroy sites that might be considered worthless by the project's engineers. Because of the intrusion of buildings, roads, fences, etc., some sites might lose the aesthetic integrity which is important to the overall quality of the site, as outlined in 36(CFR): 800.9. Sites remaining near or at the project might be vandalized due to increased access or human use; damage could include 'stripping' of wood, removal of artifacts, etc.

Transportation

Highways

Development of the Coal Canyon mine would increase traffic on U.S. 6 and I-70 between the towns in the Grand Valley and the mine site. Traffic could increase by as much as 270 vehicles per day. Because I-70 is presently operating below capacity, this small increase (5 percent of the 1976 level) would not affect safety on the highway. Coal would be trucked on a private road from the preparation plant near the mine to a rail loading facility to be built north of the Cameo power plant. The coal trucks would not cause increased traffic on public roads.

Railroads

Coal produced at the proposed Coal Canyon mine would be shipped to the point of use in unit trains using the Denver and Rio Grande Western Railroad (D&RGW) facilities. Approximately one unit train per week would be required to handle the coal. This would increase congestion on the D&RGW main line and through the major eastern Colorado cities where coal from other producing areas also passes.

Airport

The only impact on airports would be increased passenger traffic at Walker Field. Facilities are capable of handling this increased load.

Recreation

The influx of additional population due to the Coal Canyon site and the subsequently increased demand for recreation opportunities could have an impact on existing receation resources and facilities, particularly community facilities in the Grand Junction-Palisade area. Since Grand Junction's recreational facilities are now fully utilized (Grand Junction Recreation Department 1977), increased use would result in overuse which would lead to their deterioration and lower their capacity to provide enjoyable recreation. The community facilities needed to meet the increased demand and prevent overuse are projected in table MA3-2, which shows a need for 0.9 acres of active/improved park land by 1980, 3.5 acres by 1985, and 3.9 acres by 1990. Capital investments to provide the facilities are also projected in table MA3-2.

The increased demand for dispersed recreation opportunities (e.g., hunting, hiking, ORV use) should not adversely affect the recreational resource; however, concentrated use, such as an ORV rally, could lead to vegetative deterioration and reduce the recreation experience on that site. Increased use of recreational facilities (such as Island Acres Recreation Area) would lead to increased maintenance costs for the managing agencies. The extent of the increased usage and costs are not known.

The increased use of recreational facilities could be offset by providing additional facilities. The Heritage Conservation Fund Act (PL88-578), could provide monies for this purpose if matching funds are provided by the local agency. The mineral leasing funds (Colo. S.B. No. 35, Sect. 2, 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreational facilities under the Recreation and Public Purposes Act, 43 (CFR): 2740, which allows nonprofit associations to acquire lands for recreational purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior; therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The development of roads and mining facilities in Coal Canyon on the Little Bookcliffs Wild Horse Area (and wildland study area) would conflict with BLM's wildland study area management guidelines if reclamation is not successful (see Soils and Vegetation for probability of success). These conflicts could prevent the area from being included in the wilderness system.

The Coal Canyon area is winter range for the wild horses and mule deer; when concentrated in winter they provide recreation in the form of viewing and photography. Mining in the canyon could reduce the wildlife population, resulting in a corresponding loss of recreation opportunities.

Socioeconomic Conditions

Demography

In calculating the population growth associated with the Coal Canyon Mine, it was assumed that 80 percent of the mine employees would reside in Mesa County and the remaining 20 percent would reside in Garfield County. This assumption was

TABLE MA3-2

COAL CANYON: ADDITIONAL COMMUNITY RECREATION FACILITIES DEMAND

	1980	1985	1990
Population growth	260	1,050	1,190
Active/improved parks a/ (3.3 acres per 1,000 residents)	0.9 acres	3.5 acres	3.9 acres
Capital investment ($66,666 per 1,000 residents)	$17,333	$69,999	$79,333

Source: Bickert, Browne, Coddington, and Associates, Inc., Boomtown Financing Study, Vol. II (July 1976).

a/ Ballfields, tennis courts, playgrounds, etc.

based upon the commuting distance between the mine and existing communities and on the anticipated growth rates of those communities, especially as it should affect the availability of housing. In Mesa County, the Coal Canyon operation would result in a population increase of 200 people by 1980, 810 people by 1985, and 920 people by 1990. In Garfield County, the difference in population due to the Coal Canyon Mine would be about 60 people by 1980, 240 people by 1985, and 270 people by 1990.

The community of Palisade, in Mesa County, is the closest town to this mine site, as well as to the Cottonwood Creek and General Exploration Company's Cameo No. 1 mine sites. As a result, Palisade would experience a great deal of growth pressure; however, actual growth in Palisade would be limited because of its small size and water and sewer treatment capacities. As chapter 2 points out, both the water and sewer treatment facilities in Palisade are being upgraded to accommodate about an additional 1,500 people.

Most of the in-migrating population associated with the Coal Canyon Mine which does not settle in Palisade is expected to settle in the Grand Junction area. The small communities of DeBeque and Collbran would also receive some population influx as a result of Coal Canyon.

Grand Valley and Rifle are the closest communities in Garfield County to the Coal Canyon site. Since these two communities are expected to experience strong growth pressures from the numerous oil shale development operations in the same area, as well as the Cottonwood Creek and GEX mines, available housing would be at a premium. This may result in a scattering of population growth throughout Garfield County from the Coal Canyon Mine.

Community Attitudes and Lifestyles

The combined development of the Coal Canyon, Cottonwood Creek, and Cameo No. 1 mines may have a pronounced effect upon the small community of Palisade. Palisade has remained a stable, agricultural community with a relatively high concentration of older persons for some time. A rapid influx of new population would certainly threaten the present character and social structure of the community. It would also place a burden on the elderly residents as the cost of living rises due to the demand for increased local government services. General changes expected in attitude and lifestyle due to increased coal mining in the area are discussed in the regional volume.

Community Facilities and Services

The projected community facility requirements for Mesa and Garfield counties associated with the Coal Canyon operation are listed in table MA3-3. These figures were derived in a similar manner to those contained in the regional volume in table R4-19.

These cost figures do not reflect the major capital expenditures which are being made in both Mesa and Garfield counties to upgrade community facilities and services. Local governments would be dependent upon a portion of new revenues generated by the proposed action to assist in paying for projects like the $5 million water system expansion program and the $14 million sewer system expansion program planned for Grand Junction (see chapter 2, regional volume).

The local property and sales tax revenues attributed to the Coal Canyon development are listed in table MA3-4. These revenues represent the total property and sales tax revenues expected to flow to all local government entities. Since the estimated increases in community facility expenditures would be borne by county, municipal, or special district units of local government, it is necessary to subtract out the schoool district share of the revenues in order to make a comparison. If this done, it decreases the locally derived revenues available for county, municipal, and special district purposes in Mesa County would be an estimated $23,680 in 1980, $212,790 in 1985, and $240,890 in 1990. Comparing these revenues with the yearly operating expenses and amortized (assuming debt financing at 6 percent interest for twenty years) capital expenses of $112,100 per year shows that Mesa County would experience a revenue deficit from the Coal Canyon Mine in the first few years of operation, but that should change to a revenue surplus by 1985.

Locally derived revenues available for county, municipal and special district purposes in Garfield County are estimated to be $6,680 in 1980, $29,430 in 1985, and $32,980 in 1990. Comparing these revenues with the yearly operating expenses and amortized capital expenses of $31,550 per year shows that Garfield County would also experience a revenue deficit in the early years of operation. That would change to a slight revenue surplus by 1985.

The Coal Canyon Mine at full production would produce 500,000 tons of coal a year. As explained in chapter 4 of the regional volume, it is estimated that this would require an investment of $18,000,000. Property taxes on this would be $355,430 a year. Property taxes on the coal mined would be $33,030 in 1985, and $82,570 in 1990. Total property taxes could reach $438,010 in 1990. Of this $109,281 would go to Mesa County, $312,424 would go to the local school district, and $17,633 would go to special service districts. Table MA3-5 shows how the property tax revenues would be distributed among the various uses.

Housing

The projected demand for new housing in Mesa and Garfield counties as a result of population growth attributed to the Coal Canyon operation is summarized in table MA3-6. The assumptions regarding housing mix and family size that were used in the regional volume were also used in these calculations.

The housing requirements associated with the Coal Canyon Mine represent about 2 percent of the total projected new housing requirements in Mesa County by 1990 and about 1 percent of the projected new housing requirements in Garfield County by 1990. This housing and its related roadway requirements would use approximately 17 acres of land in Mesa County in 1980, 69 acres in 1985, and 78 acres in 1990, and approximately 5 acres of land in Garfield County in 1980, 20 acres in 1985, and 23 acres in 1990.

Education

The expected increase in school-aged population due to the development of the Coal Canyon Mine is shown in table MA2-7, along with the increase in school district capital requirements and operating costs anticipated from that population increase.

Most of the increase in school-aged population within Mesa County due to the Coal Canyon Mine development would occur within School District 51. Since the mine itself is also located within the jurisdictional boundaries of School District 51, that district would receive an additional $10.4 million in assessed valuation from the facility by 1990. That increase in assessed valuation would allow the district to increase its bonded indebtedness by $2.1 million, which is in excess of the projected capital facility requirements.

School District 49(JT) in DeBeque would be required to provide for some of the increase in Mesa County school population associated with Coal Canyon. Even though District 49(JT) will not benefit from any of the increase in property tax base from the Coal Canyon Mine, the tax base increase it is expected to receive from the Sheridan Mine would be more than sufficient to meet its capital requirements. The increases in school operating costs projected for Mesa County as a result of the Coal Canyon development would be met by increased school district revenues without an increase in tax rates.

In Garfield County, the increases in school-aged population from Coal Canyon would occur in the Grand Valley District 16 and the Garfield District RE-2. The total expected increase in property tax base in Garfield County by 1990 from the Coal Canyon Mine is approximately $1.1 million. That increase would allow the Garfield County school districts to raise their bonded debt by $220,000 or about $75,000 less than the estimated requirement for school capital facility needs.

Health Care

Population growth associated with the Coal Canyon Mine is expected to increase the demand for health care facilities in the Grand Junction area and the Rifle area. Due to their proximity to the Grand Junction area, neither the Coal Canyon Mine nor its two neighbors, the Cottonwood Creek and Cameo No. 1 mines, are likely to have significant adverse effects on the area's health care facilities individually. However, since population growth as a result of these three operations would affect the same area, the cumulative effect on health care service delivery is important. There would most likely be a need for expanded health care services in the town of Palisade, especially emergency services, to serve all three operations. Table MA3-8 is an estimate of the capital facilities needed in Mesa and Garfield counties to meet the projected increase in demand for health care services from all three mines in the Cameo area.

Most of the existing health care facilities in the area are supported by fees collected for services performed instead of through local tax revenues.

Employment

Development of the Coal Canyon mine in 1980 would affect employment in Mesa and Garfield counties. In 1980, 40 persons would be employed, which would increase total employment by 101 in Mesa County and by 93 in Garfield County. By 1985, employment at the mine would have reached 200 persons, increasing total employment by 403 in Mesa County and by 131 in Garfield County. By 1990, total employment would increase by 2,590 in Mesa County and by 595 in Garfield County.

Income

The eventual employment of 200 people at the Coal Canyon Mine would have a significant impact on income in Mesa County. Because no information was given by Mid-Continent about expected payroll, an average income of $16,600 per employee is assumed for analysis. Average income at the mine would be considerably higher than Mesa County's 1975 median family income of $11,130.

The total payroll for the mine would be $3,320,000 at full production. In the regional economy, this would generate another $1,726,400 for a total direct, indirect, and induced income increase of $5,046,400 in the region. Table MA3-9 shows employment, payroll, and total regional income generated annually by the Coal Canyon Mine.

TABLE MA3-3

COAL CANYON: ADDITIONAL REQUIREMENTS FOR COMMUNITY FACILITIES

	Mesa County					Garfield County				
	Physical Plant Requirements	Capital Costs 1990	Operating Costs/Year			Physical Plant Requirements	Capital Costs 1990	Operating Costs/Year		
Facility			1980	1985	1990			1980	1985	1990
Water treatment	0.32 mgd	$ 280,500	$ 4,500	$ 17,800	$ 20,100	0.094 mgd	$ 82,600	$1,300	$ 5,300	$ 6,000
Sewage treatment	0.09 mgd	$ 303,600	$ 3,300	$ 13,000	$ 14,750	0.027 mgd	$ 87,100	$ 950	$ 3,900	$ 4,350
Police protection	1 vehicle & 366 sq.ft.	$ 32,500	0	$ 40,000	$ 40,000	100 sq.ft.	$ 6,700	0	$20,000	$20,000
Fire protection	0.5 vehicle & 900 sq.ft.	$ 73,500	0	$ 18,000	$ 18,000	270 sq.ft.	$ 10,800		Volunteer	
Streets and roads	17 acres	$ 550,000	$ 3,500	$ 14,000	$ 16,500	5 acres	$160,000	$1,100	$ 4,200	$ 4,850
General government	230 sq.ft.	$ 12,850	0	$ 36,000	$ 36,000	65 sq.ft.	$ 3,600	0	0	0
Libraries	2,750 books & 500 sq.ft.	$ 33,250	0	0	0	800 books & 150 sq.ft.	$ 11,000	0	0	0
Total	-	$1,286,200	$11,300	$138,800	$145,350	-	$361,800	$3,350	$33,400	$35,200

Note: mgd = million gallons per day; sq.ft. = square feet of space.

TABLE MA3-4

COAL CANYON: INCREASED REVENUES TO GARFIELD AND MESA COUNTIES

	1980	1985	1990
Garfield County			
Property Tax			
Homes	$14,230	$ 64,800	$ 72,570
Businesses	5,130	20,540	23,110
Sales Tax	9,920	39,700	44,660
Service Fees	2,710	10,850	12,200
Total	$31,990	$135,890	$152,540
Mesa County			
Property Tax			
Homes	$47,990	$210,340	$239,230
Businesses	11,550	44,540	50,590
Mines	0	388,460	438,010
Sales Tax	26,170	101,060	114,780
Service Fee	4,960	19,120	21,740
Total	$90,670	$763,520	$864,350

TABLE MA3-5

COAL CANYON: DISTRIBUTION OF PROPERTY TAXES

Year	County	Municipalities	Special Districts	Schools
Garfield County:				
1980	$ 5,070	$1,270	$ 340	$12,690
1985	22,340	5,590	1,500	55,910
1990	25,040	6,260	1,680	62,680
Mesa County:				
1980	$ 12,530	$ 9,280	$ 1,870	$ 35,840
1985	150,580	39,740	22,470	430,540
1990	170,290	45,190	25,410	486,920

TABLE MA3-6

COAL CANYON: NEW HOUSING REQUIREMENTS

	Mesa County			Garfield County		
Housing Units	1980	1985	1990	1980	1985	1990
Single-family units	43	175	199	13	52	59
Mobile homes	17	68	77	5	20	22
Multi-family units	7	27	31	2	8	9
Total	67	270	307	20	80	90

TABLE MA3-7

COAL CANYON: SCHOOL DISTRICT FACILITY REQUIREMENTS

County and Year	Increase in School-Aged Population	Facility Requirements (square feet)	Facility Costs (dollars)	Operating and Maintenance Costs (dollars/year)
Mesa:				
1980	55	7,700	346,500	67,600
1985	160	22,400	1,008,000	196,800
1990	175	24,500	1,102,500	215,200
Garfield:				
1980	15	2,100	94,500	18,450
1985	50	7,000	315,000	61,500
1990	50	7,000	315,000	61,500

TABLE MA3-8

COAL CANYON, COTTONWOOD CREEK, CAMEO NO. 1:
PROJECTED HEALTH CARE FACILITY REQUIREMENTS

County and year	Facility Requirements	Facility Costs (dollars)
Mesa:		
1980	1 hospital bed	55,000
1985	9 hospital beds and 1 emergency vehicle	510,000
1990	10 hospital beds and 1 emergency vehicle	
Garfield:		
1980	0	0
1985	3 hospital beds	165,000
1990	3 hospital beds	165,000

TABLE MA3-9

COAL CANYON: EMPLOYMENT, PAYROLL, AND REGIONAL INCOME

Year	Employment	Payroll	Regional Income
1980	40	$ 664,000	$1,009,280
1985	200	3,320,000	5,046,400
1990	200	3,320,000	5,046,000

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce or eliminate specific adverse impacts of Mid-Continent Coal and Coke's proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the Coal Canyon mining and reclamation plan is approved, they would be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

Coal Canyon Mitigating Measure 1

Coal will be hauled only during daylight hours.

Coal Canyon Mitigating Measure 2

Power lines and associated poles will be raptor-proofed in accordance with Bureau of Land Management (BLM) standards as outlined in BLM Manual 2850 and Instructional Memorandum No. CO78-30 (February 10, 1978).

Coal Canyon Mitigating Measure 3

Water impoundments within the canyon will be fenced.

Coal Canyon Mitigating Measure 4

Mid-Continent's plans to build surface facilities and access roads within the Little Bookcliffs Wild Horse Area would be allowed according to management guidelines in the Grand Junction Resource Area Coal Update MFP (completed in September 1977). However, impacts to this area will have to be mitigated according to these guidelines.

Coal Canyon Mitigating Measure 5

Before developing any surface facilities Mid-Continent will be required to conduct a Class III Survey on these areas that would be affected by construction activities, as supported in 1971 Presidential Executive Order 11593 and 36(CFR): 800.4a. Any archeological values which are located and evaluated through this survey could be preserved through one or more of the following mitigating measures, depending upon the significance of a site: (1) avoidance of the site through redesign of the project; (2) descriptive and photographic records, or surface collecting; or (3) excavation according to a specific research design or as a salvage effort. Should archeological sites be identified during the survey efforts and placed on the National Register, compliance procedures required by Section 106 of the 1966 National Historic Preservation Act, amended 1976, and outlined in 36(CFR): 800.4-9, will be met.

Analysis of Effectiveness

Coal Canyon Mitigating Measure 1

Reducing the number of vehicles on the road during the dusk to dawn hours would reduce the road kills by an unquantifiable amount.

Coal Canyon Mitigating Measure 2

Raptor-proofing power poles would prevent electrocution of eagles and other large birds.

Coal Canyon Mitigating Measure 3

Fencing water impoundments within the canyon would prevent wild horses from using them and as a result will prevent over utilization of the habitat.

Coal Canyon Mitigating Measure 5

Identification, evaluation, and preservation of data from archeological sites before potentially damaging actions would mitigate the loss of archeological resources. The results of the Class III survey, as a 100 percent surface inventory of the impact areas, are considered to be representative of the archeological values in that area. The efficiency of the Class III survey as an identification process would depend on topography, vegetation, and past land use on each site. These factors would account for the possibility that hidden and subsurface sites would remain undetected and unaccounted for in developing any further necessary mitigating actions.

Collection and excavation are only partial mitigations. While they preserve artifacts which might otherwise be destroyed, the inplace value of those artifacts is lost. Destruction of the site would mean the loss of information which might otherwise be gained by further techniques and interpretive methods.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by the construction and operation of Mid-Continent Coal and Coke's Coal Canyon proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

The Coal Canyon Mine would increase annual average particulate concentrations by 3 micrograms per cubic meter ($\mu g/m^3$) in a small area on the mine site near the preparation plant, refuse pile, and haul road. Concentrations are predicted to increase by 1 $\mu g/m^3$ within 0.5 mile east to west and 1.75 miles north to south. Maximum concentrations from the mine directly east of the preparation plant would be 16 $\mu g/m^3$ in 1985 and 33 $\mu g/m^3$ in 1990. Visibility in the canyon would be reduced by about 2 miles by 1990; the reduction in visibility would be less in 1985.

Geologic and Geographic Setting

Topography

Minor alteration of the existing surface topography of the mine property would occur due to excavation during construction and use of the refuse disposal area. A more significant impact could result from the surface subsidence of the area. Most of the area to be mined could subside because of the shallow overburden depth in the area. The maximum subsidence under 'worst case' conditions would be 8 vertical feet.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

Mineral Resources

The producing of coal from the Coal Canyon leased area would have an unavoidable effect on the coal seam and the coal reserves, since the deposits of a nonrenewable energy source would be depleted. Based on company estimates, 7.36 million tons of coal would be mined by 2005. Production of the recoverable reserves would represent 0.7 percent of total coal reserves over 42 inches in the Mesa County portion of the Colorado section of the Bookcliffs coal field. Because of the nature of underground caving and resultant high contamination after mining is complete, future recovery of the abandoned 50 percent of the coal reserves under the lease area is not considered feasible with present technology, and therefore these reserves must be considered as lost.

Water Resources

There would be an increased consumption of municipal water of 102 acre-feet per year in 1980, 412 acre-feet per year in 1985, and 465 acre-feet per year in 1990 for both Mesa and Garfield counties.

Throughout the life of the mine, water quality changes would be minimized by the site drainage system. Nevertheless, this system is only designed for the 10-year/24-hour event. Runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site would then cause at least short duration impairment of stream quality with resultant negative impacts on aquatic biology.

Soils

Surface disturbance on approximately 0 acres by 1980 and 99 acres by 1985 and through 1990 at the mine site at the mine site would cause an increase in erosion and a deterioration of soil structure and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would prolong the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 22 acres by 1980, 89 acres by 1985, and 101 acres by 1990 from a production function. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine site on 0 acres by 1980 and 99 acres by 1985 and on through 1990. If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than these figures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action.

Wildlife

A loss of 99 acres of wildlife habitat by 1985 and in through 1990 would result from construction of surface facilities. On an additional 4,000 acres, use by deer and wild horses would decrease an average of 50 percent. This entire canyon could be lost as a winter area for both deer and wild horses due to the mining activity. The hunting grounds of the peregrine falcon and bald eagle in the riparian habitat along the Colorado River have been reduced by expansion of loadout facilities and destruction of riparian habitat.

Cultural Resources

Archeological Resources

Undiscovered sites could be damaged during surface disturbing activities and by subsidence. Information could be lost as a result of vandalism and illegal collecting and through salvage excavation procedures where any information not recorded would be permanently lost.

Transportation

Increased traffic on I-70 would be the most serious impact. Greater rail traffic would increase congestion on present facilities. Air traffic at Walker Field would also increase.

Recreation

If the community recreation facilities needed to prevent deterioration of existing facilities are not provided, this deterioration would be an unmitigated impact.

If the reclamation of surface facilities and roads within the wildland study area is not successful, this would preclude the area from wilderness status.

Visual Resources

The location of an industrial and mining complex adjacent to a natural landscape would create an unavoidable visual conflict. The presence of the proposed mine would be a definite alteration of the natural landscape character since visually incongruous elements of the proposed action could not be mitigated, and mine facilities would not blend into the surrounding landscape. For the Coal Canyon site, this conflict would eliminate that area's scenic contribution to the Little Bookcliffs Wild Horse Area, which is proposed for wilderness study.

The proposed refuse disposal site would add flat and terraced slopes onto the existing sloping landform. The lack of rainfall in Coal Canyon decreases the chances for successful rehabilitation, and this soil deposition area would remain visible for an extended period of time. Regraded slopes from the reclamation process would also remain visible because of the slow revegetation potential in the canyon.

Employee traffic and supply traffic to the Coal Canyon site would increase the I-70 traffic flow and intersection use. Trucks hauling coal to the Cameo loadout facilities would unavoidably change this area's landscape to an industrial character.

Socioeconomic Conditions

Population influx from the development of the Coal Canyon Mine and its two neighbors, the Cottonwood Creek and Cameo No. 1 and No. 2 mines, would have the greatest effect upon the community of Palisade. The resulting social changes which are anticipated in Palisade such as loss of small town atmosphere, inflation, and conflicts between new and long-time residents, would be unavoidable unless a stance is taken by the community to discourage growth.

New population from the Coal Canyon Mine would be 260 people in 1980, 1,050 people in 1985, and 1,190 people in 1990. Increases in total employment would be 194 people in 1980, 534 people in 1985 and 3,185 people in 1990. These increases are only a small portion of the total growth expected. The entire Grand Junction area's ability to absorb population growth is expected to be severely strained between 1978 and 1985, with the new population brought in by these three mines compounding the problem.

The revenue generated from Coal Canyon by local property and sales taxes in Mesa and Garfield counties would lag behind the increased expenditures needed for community facilities in the first few years of operation. By 1985, however, both counties would have a net revenue surplus from the project.

Increased school district revenues from the project would more than offset increased school costs in Garfield and Mesa counties.

In Mesa County about 17 acres of land would be required for housing the residents resulting from the Coal Canyon Mine. This would rise to 69 acres in 1985 and 78 aces in 1990. In Garfield County 5 acres would be required in 1980, 20 acres in 1985, and 23 acres in 1990.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 7.36 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment. There would be the following alterations in the short term, a period beginning with on-site construction and ending with end of mine life (about 2005) and post-mining reclamation:

1. An estimated 7.36 million tons of coal would be exported to electric-generating plants outside Colorado.

2. Annual average particulate concentrations would increase by 3 micrograms per cubic meter 1 $\mu g/m^3$ within 0.5 mile east and west and 1.75 miles north and south through 1990. Maximum 24-hour concentrations directly east of the preparation plant would be 16 $\mu g/m^3$ in 1990.

Predicted maximum 24-hour concentrations in the DeBeque Canyon area would be about 150 $\mu g/m^3$. This maximum concentration would occur in the vicinity of the loadout facility near the Colorado River and would be aggravated by the coal hauling activities of the Coal Canyon mine. Estimated source contributions of approximately 3 of the 69 $\mu g/m^3$ would be caused by Coal Canyon, 40 are due to background, 2 are due to existing sources, 3 would be caused by Cameo No. 1 and No. 2 mines, and 0 would be caused by Cottonwood Creek mines. The maximum concentration of 69 $\mu g/m^3$ is below the primary standard of 75 $\mu g/m^3$, but 9 $\mu g/m^3$ above the secondary standard of 60 $\mu g/m^3$. The area exceeding the secondary standard would be less than one square mile, centered around the combined loadout facility.

3. Throughout the life of the mine, water quality changes would be minimized by the site drainage system. Nevertheless, this system is only designed for the 10-year/24-hour event. Runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site would then cause at least short duration impairment of stream quality with resultant negative impacts on aquatic biology.

4. There would be loss of soil productivity on 99 acres through 2005 due to increased erosion, deterioration of soil structure, and reduced biological activity, and there would be loss of vegetation on those 99 acres through 2005 due to loss of soil productivity.

5. Wildlife habitat on 99 acres, which could have supported 1 deer annually, would be completely lost through 2005.

6. Increased traffic on I-70 would increase congestion and the number of road accidents.

7. The location of an industrial and mining complex adjacent to a natural landscape would create an unavoidable visual conflict. The presence of the proposed mine would be a definite alteration of the natural landscape character since visually incongruous elements of the proposed action could not be mitigated, and mine facilities would not blend into the surrounding landscape.

8. The simultaneous development of the Coal Canyon, Cottonwood Creek and Cameo No. 1 mines should have significant social and economic effects upon the eastern portion of Mesa County, and particularly the community of Palisade, over the short-term. Rapid population growth should cause housing shortages, inadequacies in local government services, and overcrowding in schools. Whether this situation persists beyond the short-term would be determined by the rate at which other resources, particularly oil shale resources, in the area are developed.

9. Total direct, indirect, and induced income generated by this project would be $5,046,700 by 1990.

Residual effects of mining (after post-mining reclamation) productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.

2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.

3. An estimated 7.36 million tons of coal, a nonrenewable energy resource, would be depleted after 2005.

4. There would be an increased consumption of at least 465 acre-feet of municipal water per year through 2005 and beyond.

5. Soil and natural vegetative productivity would be permanently lost on 107 acres due to urban expansion.

6. Surface construction, subsidence, and vandalism would disturb or destroy an unquantifiable number of nonrenewable cultural resources.

7. Archaeological survey and excavation could provide gains in understanding of prehistoric use in the area.

8. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present facilities would be a long-term adverse impact.

9. The proposed refuse disposal site would add flat and terraced slopes onto the existing sloping landform. The lack of rainfall in Coal Canyon decreases the chances for successful rehabilitation, and this soil deposition area would remain visible for an extended period of time. Regraded slopes from the reclamation process would also remain visible because of the slow revegetation potential in the canyon.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 7.36 million tons of coal would be recovered from the Loma project mines. An addditional 7.3 million tons would be lost due to current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 99 acres for the life of the mine, and irreversibly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 99 acres, which could have supported 1 deer per year, would be irretrievably lost for the life of the mine.

An irretrievable commitment of capital and land (at least 101 acres) would be required to support population growth.

Particulate air quality at the proposed mine site and for a very limited area surrounding the mine will be subject to a slight increase in concentrations. Air quality will be temporarily degraded during the mine life, but the change will not be irreversible. With termination of mining activity in 2005, air quality will return to the premining level of about 40 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean from the levels during mining of 40-43 $\mu g/m^3$.

Reduction in visibility will occur in proportion to the increased particulate concentrations. Average visibility is presently about 54 miles. Given the limited increase in predicted concentrations resulting from mining activity, visibility will not be greatly affected (52 miles) and the limited loss will be reversible. However, secondary development related to the proposed action will result in some permanent degradation of visibility in the Grand Valley area.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan is not approved. Rejection of Mid-Continent Coal and Coke's proposed Voal Canyon M&R plan would result in no additional environmental impact from coal mining on the federal leased lands. Since these lands are public lands surface use would be governed by Bureau of Land Management (BLM) policy and management guidelines and decisions. Mid-Continent could submit a new M&R plan, challenge the rejection, or abandon development of the lease.

Coal from the proposed Coal Canyon Mine is intended to supply 7.36 million tons of coal to electric-generating plants outside Colorado. Without the Coal Canyon Mine, other coal would have to be acquired to supply these markets. Such a substitution could create a shortage for other coal markets.

The mature vegetation on the coal lease tract would remain undisturbed. The vegetative conditions which at present is unsatisfactory with a downward trend, may improve in the future. The coal lease tract is part of the 26,268-acre Little Bookcliffs Wild Horse Area. The wild horse herd was reduced to 70 head in the fall of 1977 in order to alleviate the severe overgrazing of the range. The long-term effects of this herd decrease will be an increase in the desireable forage plants on the lease tract, namely western wheatgrass, Indian ricegrass, and galleta grass.

Continuing human population growth in Mesa County would still cause impacts to wildlife: expansion of urban areas onto agricultural lands and some winter range; increased recreational use of wildlife species, primarily hunting; and increased poaching of big game species.

Natural weathering and vandalism would continue to be the major causes of loss of archeological and historical values, but there should be no additional contributing factors to such loss at the site if the M&R plan is rejected. Paleontological resources would be impacted both adversely and beneficially in approximate proportion to the level of regional development and the area disturbed.

The population of Mesa County would still increase at a rapid rate to 88,050 people in 1980, 108,390 people in 1985, and 109,780 people in 1990. Development of oil shale and uranium and the area's role as a regional center account for the growth. Garfield County is also projected to grow at a rapid rate to 34,040 people in 1980, 42,660 people in 1985, and 46,330 people in 1990, also primarily as a result of oil shale development.

Mesa and Garfield counties', towns, special districts, and the school district would not receive increases in revenue amounting to $122,660 in 1980, $899,410 in 1985, and $1,016,890 in 1990. Of course expenditures to provide facilities and services to accommodate population icnreases associated with Coal Canyon would not have to be made. Total income in the county would be reduced by $1,009,280 in 1980, and $5,046,400 in 1985 and 1990.

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transports, and rates of production have been considered but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geology and geographic characteristics of the area. Any new alternatives presented by the review process will be carefully considered.

MID-CONTINENT COAL AND COKE:

COTTONWOOD CREEK
NO. 1 AND NO. 2 MINES

CHAPTER 1

DESCRIPTION OF THE PROPOSAL

Proposed Action

The proposed action is the review and consideration for approval of a mining and reclamation (M&R) plan submitted September 1, 1977, to the Office of the Area Mining Supervisor, U.S. Geological Survey (USGS), Denver, Colorado, by Mid-Continent Coal and Coke Company. The M&R plan for the Cottonwood Creek No. 1 and No. 2 Mines has been accepted by the USGS as suitable for use in preparing this environmental statement (ES) and is available for public review at the Area Mining Supervisor's office in Denver. This M&R plan was submitted for review prior to promulgation of the initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) and has not been officially reviewed for compliance with that act. Therefore, the applicant's plans may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations.

The M&R plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulation in 30(CFR): 211 and 30(CFR): 700. The M&R plan cannot be approved until it conforms to all applicable federal requirements.

The plan describes the proposed Cottonwood Creek No. 1 and No. 2 mines to be located on the south side of the Colorado River at the mouth of DeBeque Canyon, approximately 14 miles northeast of Grand Junction. The Cottonwood Creek Mine property consists of federal coal leases C-020740, C-024998, and C-029889, totaling 5,113 acres, as well as three adjacent private coal leases: the Lekas tracts, the Blue Flame tract, and the Midwest Red Arrow tract, totaling 454 acres (see map MB1-1).

The Cottonwood Creek No. 1 and No. 2 mines would be new underground bituminous coal mines with an anticipated combined annual production of over 1 million tons, with potential reserves (62 million tons estimated) for a mine life exceeding 25 years. At full production, the mines would employ 400 persons. The coal to be produced would be steam coal and most likely would be shipped by rail to electric-generating companies outside Colorado.

The federal lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.

History and Background

The Cottonwood Creek No. 1 and No. 2 mines are a joint venture of Mid-Continent Coal and Coke Company along with Pitkin Iron Corporation, Eldon Coal, James Brothers Coal Company, the James Brothers, and GEX-Colorado Company, a subsidiary of General Exploration Company. To date, Mid-Continent and GEX-Colorado have reached no firm agreements. However, Mid-Continent has submitted the mining and reclamation plan on the assumption that negotiations can be successfully concluded.

There are three small abandoned mines on the Cottonwood Creek properties, all primarily on private land: the Midwest, the Blue Flame, and the Winger. The Midwest Mine produced 157,073 tons of coal from the Palisade seam from 1908 to 1949. About 5.5 feet of an 8-foot-thick seam were mined at the Blue Flame from 1933 to 1968, producing 97,984 tons of coal. The mine is located on 80 acres of private land currently owned by James Brothers Coal Company. The Winger Mine, also known as the New Grand Mesa (1911-12) and the Go-Boy (1961-68), operated from 1911 to 1968. From 4 to 9 feet of a 9- to 12-foot-thick seam were mined, producing 148,402 tons of coal. The mine is located on a 120-acre private tract owned by Pitkin Iron Corporation, adjacent to and south of the Blue Flame tract.

Predisturbance Inventories and Analyses

The Historical Museum and Institute of Western Colorado, Grand Junction, Colorado, completed an archeological inspection of the Cottonwood Mine area on July 28, 1976. The soils of the mine area are identified in the Mesa County Soil Survey (in press). The Bureau of Land Management (BLM) has completed an endangered and threatened plant literature search and an herbarium survey. Also, BLM performed a preliminary vegetation study in

the fall of 1977 and will complete a vegetative inventory for rare and endangered plants during 1978. The Colorado Division of Wildlife has completed an inventory and study of the area for rare and endangered animals and birds.

Stages of Implementation

Development of the property is planned in several stages, depending on current negotiations among the several interests involved. All surface facilities needed for operations have been constructed at the Roadside Mine and are in operation. Mid-Continent would use ventilation shafts of the Roadside Mine located in federal lease C-020740 for access from the Roadside Mine.

Mid-Continent proposes to begin producing 100,000 to 200,000 tons of coal annually from the Cottonwood Creek property. Production would increase stepwise until the design production rate of 1 million tons of coal annually is reached in the fifth project year. The work force at that time would be approximately 400 people. A mine life exceeding 25 years is projected. (Table MB1-1 summarizes the employment and production schedule.)

Mine Layout

The Cottonwood No. 1 Mine would be in the upper Carbonera coal seam. (Figure MB1-1 is an aerial photograph of the proposed mine site, and map MB1-2 shows the mine layout.) The Carbonera seam averages 8.0 feet in thickness but is commonly split into as many as ten partings and is too thin to mine in the northern portion of the lands. Access to the No. 1 Mine would be through rock slopes driven upward from the No. 2 Mine in the Cameo seam, 38 to 93 feet below the Carbonera seam. The Cameo seam averages 6.5 feet in thickness over the property.

Mid-Continent would use the ventilation shafts of the Roadside mine for access to the properties. These ventilation shafts would essentially become entries into the Cameo seam for the No. 2 Mine (see map MB1-2).

Development would next proceed south to a point near the south end of the Winger Mine (map MB1-2). From this point, short entries would be driven east; then rock tunnels would be driven north, upslope to the No. 1 Mine in the Carbonera seam; then the Carbonera 2 West entry would be driven to the outcrop. Ventilation and access would be established at the 2 West Carbonera entry, and later at the 1 West Carbonera entry after they are completed. If firm agreements between the companies involved cannot be reached, then the 1 West and 2 West Carbonera would be developed first.

As initial development of the 1 North entry continues south, additional development would be started to the east in the Cameo seam along the North Bleeder, 6 East, and 5 East entries. Information from the management of the Roadside Mine and extrapolations of drill-hole data indicate that the Carbonera seam would not be economically mineable in this area.

Development work would be done with continuous miner units, each consisting of a continuous miner, two shuttle cars, a feeder-breaker, a section power center, and a roof-bolting machine. Cambridge Mining Company currently uses both extensible belts and shuttle cars. Early development would use the belts for section haulage.

After development work, longwall methods on a fully retreating system would be in general use. In areas west of the north-south mains, it is expected that coal between the outcrops and the mains would be removed by room-and-pillar methods by retreat mining. Coal from this development would be processed through the Roadside Mine facilities.

Support pillar and entry widths would be designed for optimum roof support and maximum coal recovery, depending on ground conditions as mining progresses. At present, the Roadside Mine is developing entries in the Cameo seam with 100-by-100-foot support pillars.

Roof support plans would be developed and submitted to the Mine Safety Health Administration (MSHA) for approval. Exact details would depend largely on early mining experience. Drill-hole data indicate that control conditions may be highly variable; there may be roof control and even bottom-heaving problems. Conditions would be evaluated as mining progresses, and normal safety and support procedures would be followed as specified in 30(CFR): 75.

Ventilation System

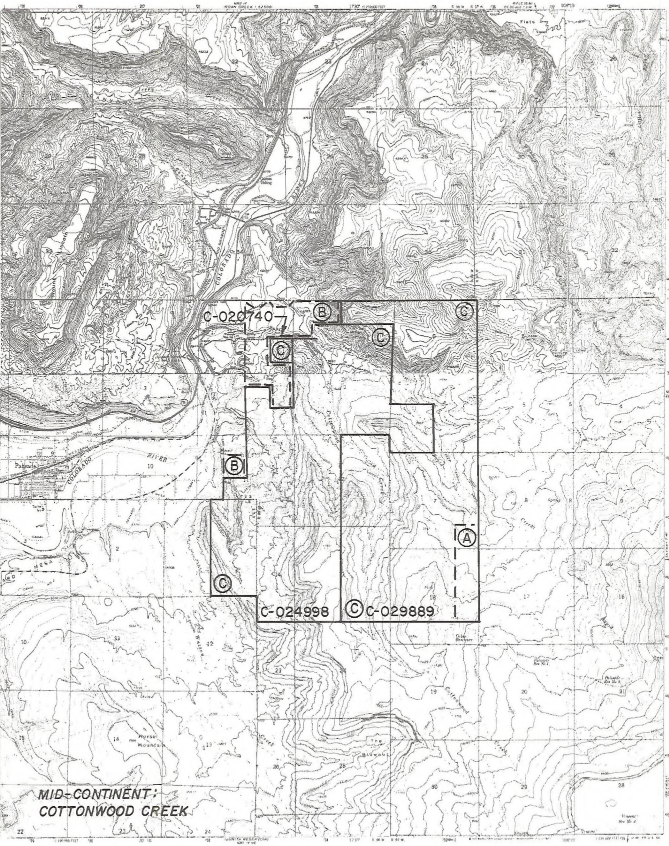
The mines would be ventilated by axial exhaust fans at the portals. Experience in the Cameo seam at the Roadside Mine indicates that methane probably would not be present; therefore, very large quantities of air normally required in a gaseous mine would not be necessary. Exact ventilation designs would depend on the actual location of mining sections and mining sequences. Ventilation plans would be approved by MSHA.

Haulage System

Coal would be hauled from the producing sections to the portals by belt conveyors. Transportation in the mine would be by MSHA-approved electric and/or diesel-powered equipment. The main supply systems probably would be by electric locomotive and mine track.

Surface Facilities

During the initial development phases, the surface facilities of the Roadside Mine would be used



——— FEDERAL LEASE
- - - - PRIVATE LEASE

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

Ⓐ PRIVATE SURFACE, FEDERAL MINERAL
Ⓑ PRIVATE SURFACE, PRIVATE MINERAL
Ⓒ PUBLIC LAND SURFACE, FEDERAL MINERAL

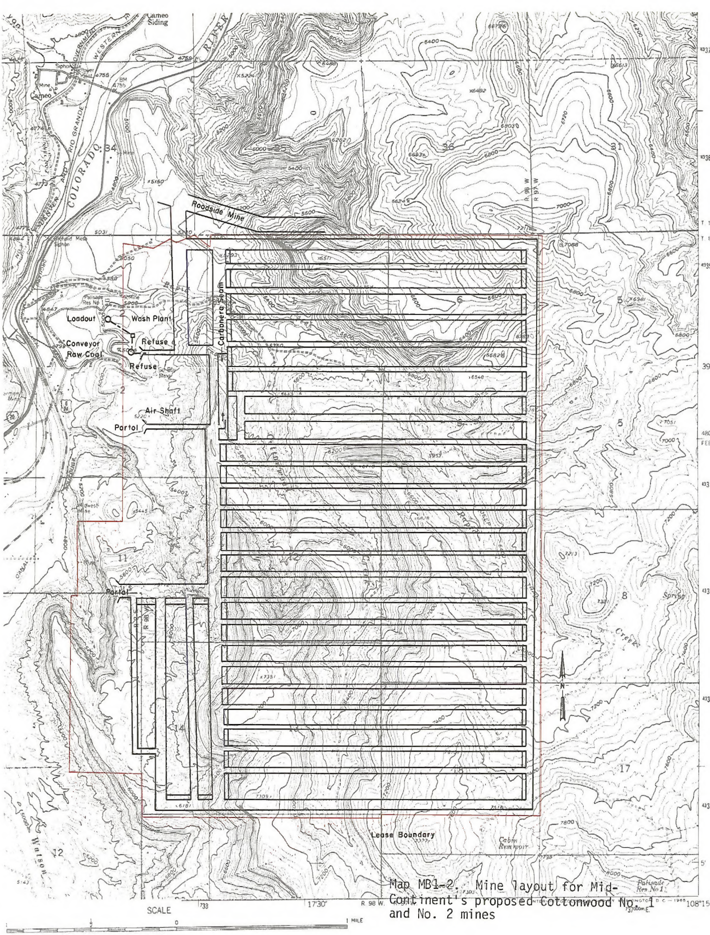
Map MB1-1. Mid-Continent Coal and Coke's Cottonwood Creek lease area

TABLE MB1-1

EMPLOYMENT AND PRODUCTION SCHEDULE

Year	Employment	Production
1982	50	--
1983	95	100,000
1984	220	200,000
1985	400	400,000
1986	400	550,000
1987	400	700,000
1988	400	1,000,000

Figure MB1-1. Looking northeast up DeBeque Canyon from just south of Palisade, Colorado. The Little Bookcliffs escarpment and the abandoned midwest Mine are in the foreground. Point A indicates the site of Mid-Continent Coal and Coke's Cottonwood Creek No. 1 and No. 2 mines. (This view lies directly south of the area shown in figure G1-1, in the General Exploration site-specific analysis.)



Map MB1-2. Mine layout for Mid-Continent's proposed Cottonwood No. 1 and No. 2 mines

to process the coal from the Cottonwood Creek Mines. After the 2 West Carbonera entry is developed to the outcrop, surface facilities to support a large underground mine operation would be constructed to conform with all applicable governmental regulations. The facilities would cover approximately 16 acres. The area shown in map MB1-2 would be used as a service area for the mine and mine site. Facilities incidental to normal underground mining activity would be constructed. The facilities may include, but would not necessarily be limited to the following:

Offices
Shops
Parking lots
Bathhouse-locker
Lunchroom
Water storage
Portals
Hoist or trolley house
Fans
Waste water disposal
Laboratory
Warehouse

Construction would probably begin with portal work and ventilating fans after the 2 West Carbonera entries are broken out. Most facilities would be completed at about the same time as the preparation plant. The portal facilities would cover approximately 7 acres.

PREPARATION PLANT

Mid-Continent proposes to construct a preparation plant covering approximately 2.5 acres in the general area shown on map MB1-2. The plant would be large enough to handle in excess of 1 million tons of coal per year. The plant would have standard sizing and washing equipment with a closed water loop and all normal and necessary safety and pollution control facilities. In addition, a dryer may be constructed. Two products would be discharged from the plant: (1) clean coal, which would be hauled by truck to a proposed rail loadout facility south of Public Service Company of Colorado's Cameo Plant, and (2) refuse, which would go to a disposal site.

LOADOUT FACILITIES

A clean-coal storage facility of less than 1 acre would be constructed. The proposed facility would include a clean-coal bin, a clean-coal surgepile, feeders, and a scale. There would also be a truck turnaround and parking area. The facility would be designed to meet all applicable governmental, zoning, safety, and environmental requirements. The clean coal would be transported by trucks to a unit-train loadout facility to be located north of the Cameo power plant. The unit train facility is being constructed by GEX.

REFUSE DISPOSAL

Combustible materials (primarily paper, wood, and garbage) from the service area and from the mine would be either disposed of on-site or transported to applicable disposal facilities. If disposal is on-site, all pertinent governmental regulations would be followed.

Shale, bone coal, parting material, and similar refuse would be removed from mine-run coal at the preparation plant. This refuse would probably amount to over 300,000 tons per year at planned mine capacity. It first would be used for fill material to aid in development of the mine site and then will be disposed of in the approximately 35-acre area shown on map MB1-2.

WATER SYSTEM

Mid-Continent proposes a system that would use up to 46 acre-feet of nonpotable water per year. The preparation plant would use 10 to 15 million gallons of water per year. The system would be supplied by water from the mine, supplemented if necessary from local water utilities. If the mine has more water than can be used in the preparation plant, water storage/evaporation ponds covering approximately 2 acres would be constructed so that there would be no discharge of mine water. Berms and dikes would be constructed, and surface facilities and the refuse-disposal area would be designed so that any contaminated surface runoff from precipitation could be contained. This water would go to storage/evaporation ponds and could be used in the above water system. Drainage facilities and settling ponds would be maintained at all times so that no water from the mine site would be discharged.

Mid-Continent expects to purchase 6.1 acre feet of domestic water from either the Palisade Reservoir No. 1 or the proposed Ute District pumping plant. Domestic water would be piped to the site.

POWER FACILITIES

Power for the mine would be supplied by the Cameo Plant of Public Service Company of Colorado. During initial development, most of the underground power requirements would be supplied from facilities of the Roadside Mine. Mid-Continent would build a main substation in the vicinity of the 2 West Carbonera entries. Secondary power lines would be run from the main substation to the various facilities required on the property; existing secondary power lines and poles, used for the Winger Mine (Go-Boy), would be used where possible.

ACCESS ROADS

Existing roads, used in the past for mine access and coal haulage, are presently used for access to private residences, orchards, and two water storage and treatment facilities. For proper access to the mine property, it would be necessary to construct

1,000 to 2,000 feet of new road. Mid-Continent would work with Mesa County officials on the location, funding, and type of access road needed, as well as on any improvements needed for the road from the Interstate 70 service road to the access road. Total road relocation and upgrading would disturb approximately 10 acres.

The road on company property would follow an existing dirt road used for access to the Go-Boy Mine. This road would require some relocation and would be improved for safety, drainage, etc. Abandoned sections of the road would be reclaimed.

The clean-coal haul road would follow an existing road used to haul coal from the Winger Mine. This road also would be improved. Improvements off company property would be coordinated with Mesa County officials for alignment, funding, etc.

Several dirt roads and jeep trails provide access over the property. Company personnel would seldom use these roads, and no improvements are anticipated. Roads would be sprayed with water to control dust.

Surface Reclamation

When the mineable coal reserves are exhausted and the facilities are no longer needed, the lands would be prepared for permanent abandonment. All mine portals would be sealed with reinforced concrete and back-filled to the surface. Surface structures, including concrete foundations, would be removed entirely. The areas would be graded covered with soil and seeded. Refuse and spoil disposal areas would be covered with topsoil and seeded. The disturbed areas would be restored to the original use.

Authorizing Actions

This M&R plan was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Section 502 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87). Therefore, this plan does not fully reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan was designed using the requirements of the initial regulations. Before the plan is forwarded for approval by the Secretary of the Interior, it will be returned to the mining company for redesign to incorporate the applicable initial regulations.

As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations at 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is goverened by the regulation 30(CFR): 715.15.

The standards and measures described in those regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

Federal Agencies

Before approval of the M&R plan is granted, BLM must concur with Mid-Continent's proposal following redesign according to 30(CFR): 211 and 30(CFR): 700, regulations and review by USGS and OSM. USGS would, with BLM concurrence, approve the M&R plan. OSM would review the M&R plan and, following redesign according to 30(CFR): 700 regulation, would approve it along with USGS approval and BLM concurrence.

State and County Agencies

Air quality, solid-waste disposal, water quality, and mining and reclamation of mined land must comply with rules and regulations administered by the various divisions within the Department of National Resources. Approval of the M&R plan, permits and licenses to mine coal must be obtained from the state of Colorado. Mid-Continent would also have to obtain rights to use any mine water in their operations from the State Engineer.

Mid-Continent would have to obtain a special-use permit from Mesa County and comply with stipulations given by the county.

Interrelationships

Relationship to Other Existing and Proposed Developments

The Roadside Mine, operated by GEX-Colorado, is the only active mine in the area of the proposed Mid-Continent Cottonwood Creek Mines. (See map 1 in appendix A.) It is approximately 1.5 miles north of the proposed Cottonwood Creek Mines. Annual production from the Roadside in 1977 was 300,200 tons of coal from both private and federal leases. The coal was trucked from the mine to the purchasers. GEX-Colorado is also in the process of opening the abandoned Cameo No. 1 and No. 2 Mines, which are approximately 0.5 mile northwest of the Roadside Mine.

Initial development of the Cottonwood Creek No. 1 and No. 2 mines is expected to be done by GEX-Colorado from the existing Roadside Mine. This initial development would utilize three ventilation shafts that were developed by GEX-Colora-

do through federal lease C-020740. In addition, coal preparation and haulage would use surface facilities of the Roadside Mine until the third project year.

The Cameo steam electric plant of the Public Service Company of Colorado is approximately 1 mile north of the Cottonwood Creek Mine portals.

The Denver & Rio Grande Western Railroad (D&RGW) main line, which parallels Interstate 70 and the north bank of the Colorado River, is approximately 3 miles by road east of the Mid-Continent operation. GEX-Colorado is constructing a railroad loadout facility on the north side of the Colorado River which would be used by both GEX-Colorado and Mid-Continent. The loadout facility would be a short spur off the main line of D&RGW in DeBeque Canyon. (Figure MB1-2 is a photograph of the proposed loadout facility.)

Housing and service facilities exist in the area. The Cottonwood Creek Mines would be approximately 2 miles northeast of Palisade, which is approximately 12 miles east of Grand Junction. Experienced labor is in short supply in the area because agriculture is the main stay of the area.

Relationship to BLM Land Use Plans

The 5,113.29 acres of public lands included in this M&R plan are administered by the BLM's Grand Junction District. They are subject to the management guidelines that were developed in the Whitewater Management Framework Plan (MFP), completed in April 1977, and the Grand Junction Resource Area Coal Update MFP, completed in September 1977.

The surface overlying Mid-Continent's lease holdings has been primarily used for livestock grazing and wildlife habitat. There has been very little public recreation use of the area because of a lack of legal public access. The privately owned sections of this proposal have been mined for coal for a number of years.

Figure MB1-2. The loadout facilities being constructed by General Exploration in the Cameo area would be used by Mid-Continent for the Cottonwood Creek and Coal Canyon mines, as well as by GEX for the Cameo mines.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, and cultural resources and the socioeconomic conditions which constitute the site-specific environment in which Mid-Continent Coal and Coke Company proposes to develop federal coal. The description focuses on environmental details most likely to be affected by Mid-Continent's proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunderstorms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air movements.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Cottonwood Creek mine site is located east of the Colorado River at the mouth of DeBeque Canyon. Elevation at the site is 5,200 feet. No meteorological measurements are made on site. Data from the Grand Junction weather station indicate that the average annual temperature is 53 degrees Fahrenheit and annual precipitation is about 8 to 9 inches. The growing season is 188 days (based on 32-degree freeze threshold data). Evaporation is estimated to be about 45 inches annually.

Wind data were collected in the Mt. Logan-Mt. Callahan reach of DeBeque Canyon northeast of the proposed site. The data showed high wind speeds (greater than 12 miles per hour 41 percent of the time) with apparent strong channeling up and down valley. However, the difference in elevation at this monitoring site and the Cottonwood Creek site-- 8,800 feet versus 5,200 feet--makes it uncertain whether meteorological conditions at the higher elevation are necessarily representative of conditions near the mouth of the canyon. For this reason, the Grand Junction wind rose was used and adjusted to reflect the northeast wind direction of DeBeque Canyon. Prevailing wind direction is down valley or from the northeast with an average speed of 8 miles per hour (figure MB2-A).

Air Quality

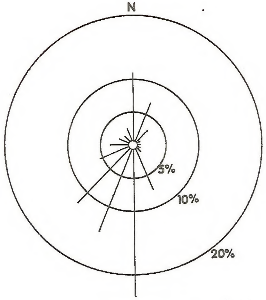
Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations vary from 20 to 40 $\mu g/m^3$.

The available particulate sampling data which best represent existing particulate air quality at the proposed Cottonwood Creek site are from a state-operated sampler located about 1 mile north of the proposed mine site.

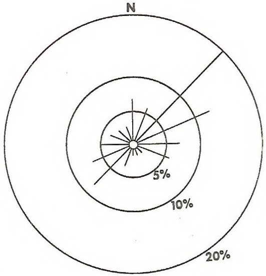
The annual geometric mean concentration recorded at the sampling site was 42 $\mu g/m^3$ with first and second maximum 24 hour concentrations of 158 and 132 $\mu g/m^3$, respectively. These concentrations presumably include the impact of an existing mine (Roadside) and a power plant in the same vicinity.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutant concentrations in the vicinity of the proposed mine site. The Cameo power plant is likely to affect concentrations at the mine site. However, the degree of impact is unknown.

Visibility at the site ranges from less than 1 mile to approximately 100 miles throughout the year. Average visibility is about 54 miles with greatest visibility occurring during spring and summer months.



Upper DeBeque Canyon



Lower DeBeque Canyon

Figure MB2-A. Annual wind frequency in upper DeBeque Canyon and near the proposed Cottonwood Creek site

Geologic and Geographic Setting

Topography

The proposed site of the Cottonwood Creek No. 1 and No. 2 mines lies immediately southeast of the Colorado River. The lease area occupies the southern rim of DeBeque Canyon and the northern slopes of Grand Mesa. (See map MB1-1). The Little Bookcliffs escarpment lies just north of the Colorado River.

The lease area consists of northwest and north trending ridges separated by deeply cut intermittent and small perennial stream drainages. These small streams drain to the northwest directly into the Colorado River. North of the leases, the Colorado is narrowly confined to a small steep-sided valley (DeBeque Canyon) by resistant sandstone beds. However, to the west of the leases where the Colorado has eroded through the sandstones and onto soft shales, the valley rapidly broadens. The broader valley, the Grand Valley, is over 30 miles wide near Grand Junction, Colorado.

Elevations on the lease area vary from about 4,820 feet in the gulch just south of the Midwest Red Arrow Mine to 7,675 feet at the south end of the property near Cabin Reservoir. Slopes on the lease area range from 7 percent along terraces adjacent to the Colorado River to 75 percent near the southern boundary. In some small areas on the leases, resistant sandstone benches have formed vertical cliffs.

Cottonwood and Rapid Creeks drain the lease area. The gradient of Cottonwood Creek is 9.5 percent for the 3.45 miles of the stream within the property boundary. Rapid Creek averages 9.2 percent for the 3.5 miles of stream within the property boundary.

Landforms

The lower areas of the lease area are dominated by a large bench formed by the erosion of the Cameo-Carbonera coal interval directly over the Rollins sandstone, which forms major cliffs.

Structure

Structurally the Cottonwood area is quite simple. A general dip of 2 degrees to 3 degrees north-northeast was determined, although dips as high as 5 degrees occur in the northwest corner of the lease area. In addition, a small, very slight anticlinal flexure exists in the center of the lease area. There is no known faulting.

Stratigraphy

Outcrops of rock strata on the lease area are restricted to for mations of Upper Cretaceous, Tertiary, and Quaternary ages. In ascending order, the formations present are the Mesaverde group of Upper Cretaceous age; the Ohio Creek and Wasatch formations of Tertiary age; and Quaternary colluvial deposits. These formations will be described in ascending order (that is, from oldest to youngest).

The Mesaverde group of Upper Cretaceous age consists of the Mt. Gar field formation and the overlying Hunter Canyon formation. The only coal on the Cottonwood Creek property occurs in the Mt. Garfield formation, which contains three coal seams of economic significance: the Palisade, the Cameo, and the Carbonera seams (see figure MB2-1)

Mid-Continent reports that, according to drill data, the Palisade seam is 3 to 4 feet thick near the old Midwest Mine but thins rapidly to the west, south, and east. The average thickness over the entire lease area is 2.58 feet.

The Cameo coal seam overlies the Palisade by 400 to 450 feet and (according to company estimates) covers approximately 4,040 acres of the property. The Cameo is the most productive seam of the Little Bookcliffs coal field. It is characterized by a relatively large quantity of high ash bone coal, occasional carbonaceous shale beds, and sandstone dikes. The Cameo ranges from 5.66 to 9.51 feet and averages 6.46 feet. The company reports the Cameo is thickest in the northern and western parts of the lease area and thins to the southeast.

The Carbonera seam overlies the Cameo seam at distances of 38 to 93 feet on the Cottonwood property covering approximately 4,850 acres according to company estimates. It is a series of detached seams rather than a single bed. The company reports that the Carbonera appears to thicken and become considerably cleaner toward the southern end of the property. The Carbonera ranges from 6.79 to 13.31 feet, averaging 9 feet.

The remaining 200 to 400 feet of the Mt. Garfield formation consists of interbedded to laminated carbonaceous, silty, fine to very fine grained sandstones, and carbonaceous sandy siltstones.

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be considered in the ES process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table MB2-1. Due to the present lack of data and accepted criteria for determining significance, the importance of these pale-

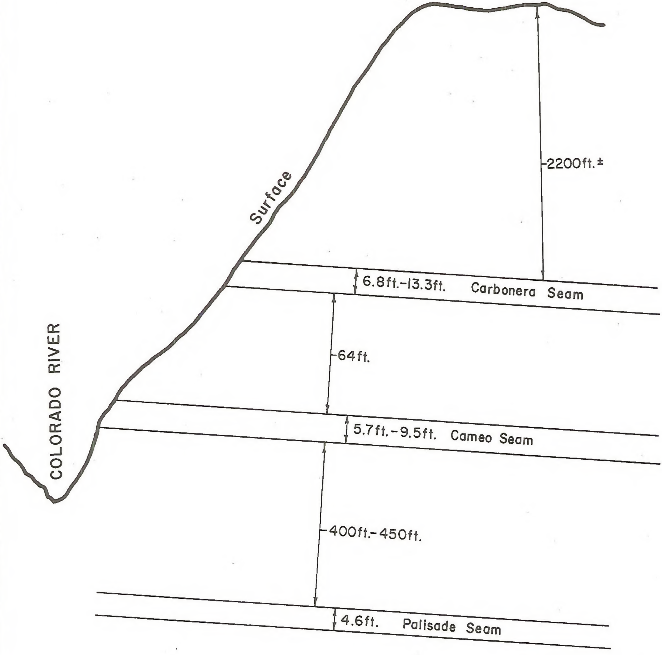


Figure MB2-1. Schematic of coal seams at the proposed Cottonwood No. 1 and No. 2 mines

TABLE MB2-1

SUMMARY OF FOSSIL-BEARING FORMATIONS IN THE AREA
OF THE PROPOSED COTTONWOOD CREEK MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils b/
Mancos shale	Upper Cretaceous	General	I, V,
Mt. Garfield	Upper Cretaceous	General	I, V, P
Hunter Canyon	Upper Cretaceous	General	I, V, P

a/ General = formation contains fossils throughout; specific localities are not identified.

b/ I = invertebrate; V = vertebrate; P = paleobotanical

ontological resources to science, education, etc., cannot presently be assessed.

The BLM and U.S. Geological Survey (USGS) are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

Mineral Resources

Coal

Mid-Continent estimated 13 million tons of coal for the Palisade seam on the property; however, this coal would be uneconomical to recover under present mining tecniques. The Cameo seam contains an estimated 57 million tons of which 28.5 million tons would be recoverable under present mining techniques. At present, the Carbonera seam is estimated by the company to contain 68 million tons of coal, of which 34 million tons would be recoverable under present mining techniques. Because of the many splits within the Carbonera, correlation is difficult and the reserves may be subject to a rather drastic downgrading.

Both the Cameo and Carbonera seams outcrop along the western side of the Cottonwood property. There is a maximum overburden of about 1,700 feet over the Cameo, averaging about 850 feet, and 1,635 feet over the Carbonera.

Table MB2-2 lists the in-place and recoverable reserves estimated by the USGS and coal quality by seam on federal leases C-020740, C-024889, and C-024998 and private coal leases.

Oil and Gas

A potential for oil and gas exists under the coal reserve block of Cottonwood Creek. A well is soon to be spudded-in approximately 1.5 miles southwest of the southwestern property boundaries.

Water Resources

Surface Water

The upper part of the lease area lies along the Colorado River, approximately 1.6 miles upstream from Palisade, Colorado. Records from a river gauging station (No. 09095500) located 7 miles northeast of Cameo, Colorado, show that the average annual discharge of the Colorado River is 3,864 cubic feet per second (cfs), or 2,799,000 acre-feet. Peak flow in excess of 11,000 cfs occurs during May and June as a result of melting snowpacks. The lowest flow on record is 700 cfs, December 29, 1939.

Two major drainages run through the lease area, Rapid Creek and Cottonwood Creek. These drainages are both ephemeral, flowing for less than one month of a calendar year, after summer thunderstorms which produce surface runoff.

Cabin Reservoir, located about 500 feet outside the southeast corner of the lease area, is a spring-fed reservoir, developed as part of the Palisade water system. Its storage capacity is 166 acre-feet. Old, cast-iron water supply pipes, ranging from 6 to 10 inches in diameter, run through the proposed lease area on the way from Cabin Reservoir to Palisade (figure MB2-2).

Ground Water

Data from exploratory drilling indicate that the only significant water-bearing horizon is located at the top of the Rollins sandstone. Mine water is expected in the Cameo seam, but the Carbonera seam is not expected to yield significant quantities of water.

The Rollins sandstone is located within the lower Mesaverde formation, which is the source of many springs and wells. The ground water flow in this formation is controlled by interstitial porosity, meaning that water is contained and transmitted through interconnected pore spaces betweeen grains within the sedimentary bedrock. Water yields from the formation vary between 0 and 50 gallons per minute (gpm) but generally average 10 gpm.

Water Quality

The Colorado River is classified as a B1 quality water system by the Colorado Department of Health. A discussion on the Colorado River is found in the regional volume.

There are no available data for Rapid and Cottonwood creeks because of the infrequency of flow. Characteristically, when flow does occur in these ephemeral drainages in response to summer thunderstorms, the water level rises and falls rapidly, termed 'flash flooding.' As these flash floods move down the channel, they first scour and then fill the channel bottom, and then leave flood deposits on the valley floor after they recede. The resultant quality of these flash flood waters can be classified as very poor with suspended sediment loads typically in the tens of thousands parts per million.

The quality of the ground water is similar to that of the rest of the Mesaverde formation in the region. The quality of ground water in the Mesaverde group can generally be expected to be of poor quality. Analysis of water throughout this aquifer show that excessive iron, manganese, sulfate, and fluoride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1973, Price and Arnow 1974, and Brogdon and Giles 1977). Typi-

TABLE MB2-2

RESERVES AND COAL QUALITY OF THE COTTONWOOD PROPERTY

Seam	Acres Covered in M & RP	Average Thickness (feet)	In-Place Reserves (million tons)	Recoverable Reserves (million tons)	BTUs	S (percent)	Ash (percent)	Moisture (percent)	Fixed Carbon (percent)	Volatile Matter (percent)
Palisade	3,000	2.5	13.0	Uneconomical	11,161	1.07	15.11	7.58	48.08	36.80
Cameo	4,040	7.65	57.37	28.69	10,426	0.87	15.6	7.2	43.8	35.85
Carbonera	4,850	8.2	65.85	32.93	10,675	0.85	20.1	7.8	38.6	36.05

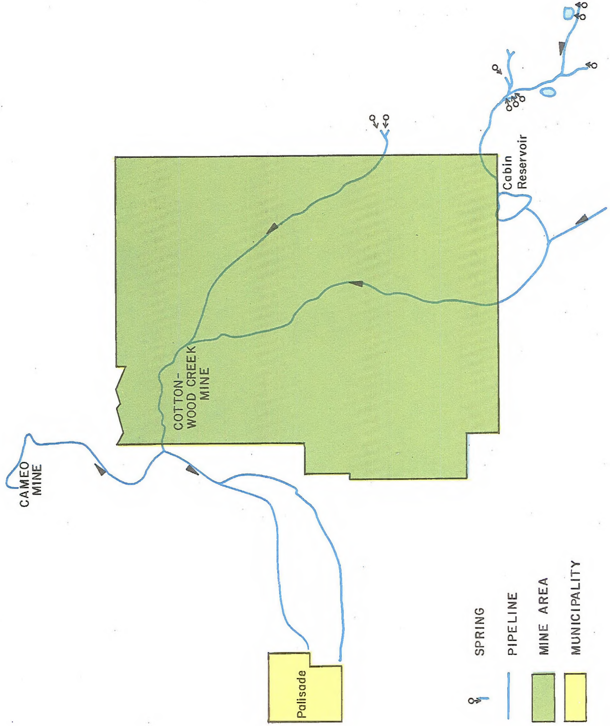


Figure MB2-2. Relationship between Palisade, Cabin Reservoir, and the Cottonwood lease area

cally the water is of poor chemical quality for domestic or public uses.

Soils

The entire area of proposed mine surface activity is contained within a single soil mapping unit. This unit consists mostly of rock outcrops on very steep slopes with nondelineated soil inclusions that are generally stony or gravelly. Also included are landslide areas and small pockets of shallow and very shallow soils. Specific soil features of importance in assessing reclamation are rated in table MB2-3; brief explanations of each rating are contained in the footnotes.

Vegetation

The vegetation of the coal lease area consists of greasewood, saltbush, sagebrush, pinyon-juniper and mountain shrub types. (See map MB2-1.) Greasewood is found along Cottonwood and Rapid creeks, the major drainages which transect the coal lease tract. It is supported by the high water table beneath these two creeks. Plants commonly associated with the greasewood stands are saltcedar, summer-cyprus, Russian thistle, and snakeweed.

Saltbush is located in the western part of the lease area, on the arid, rolling hills immediately east of Palisade. The primary species in the saltbush type are shadscale, galleta grass, snakeweed, and prickly pear cactus. Scattered bunchgrass stands of beardless wheatgrass are found, as well as a few small stands of big sagebrush.

Large stands of big sagebrush are found in the southeastern part of the lease tract, between the pinyon-juniper and mountain brush types. They occur on relatively level mesas which have deeper soil deposits than the adjacent rocky slopes.

Pinyon-juniper is the most widespread vegetation type, occupying most of the eastern two-thirds of the tract. The understory is characteristically sparse, consisting mainly of cheatgrass, snakeweed, galleta grass, and Indian ricegrass.

Mountain shrub occurs in the southeastern part of the lease tract, alternating with the large sage parks that are also present there. The most abundant plants in this type are gambel oak and serviceberry; many other shrubs and herbaceous understory plants are associated with them.

Some south-facing slopes of the lease tract are almost totally devoid of vegetation, as a result of the high evapotranspiration rate of southern exposures and the low water-holding capacity of the steep Mancos shale slopes. The area between the coal lease tract and the town of Palisade is agricultural land, planted mainly with fruit trees. No data are available on aquatic vegetation in the area proposed for mining.

A more detailed discussion of the plant species composition of the vegetation types mentioned, as well as their relationship to climatic and topographic features and to each other, may be found in chapter 2 of the regional analysis. Scientific names of the plants discussed are in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the *Federal Register* (see table R2-10 in regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State University, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Cottonwood Creek Mine. The results of the literature and herbarium studies may be seen at the Bureau of Land Management Montrose District Office. A detailed floristic and endangered and threatened plant inventory of the natural vegetation that is expected to be disturbed by the Cottonwood Creek mine facilities and roads has revealed that no endangered or threatened plants are present. The results of this inventory are available for public review at the Grand Junction District Office.

Wildlife

All terrestrial species known or expected to occur in the Cottonwood Canyon lease area are listed in appendix C.

Big Game

MULE DEER

The Cottonwood Canyon area is mule deer winter range, with the lower portions of Cottonwood and Rapid creeks considered to be crucial winter range (map MB2-2). Deer remain on the winter range from October or November until early April and then gradually move to higher elevations as snow melts and new vegetative growth becomes available. They summer on the Grand Mesa National Forest, away from the lease area. Pellet group transects in the Cottonwood Creek area indicate an average of 56 deer days of use per acre in this crucial habitat.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule

TABLE MB2-3

SOIL FEATURES FOR MID-CONTINENT: COTTONWOOD CREEK MINING AREA

Mapping Unit Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
Rock Outcrop				
Rock Component	-	-	-	-
Deep Stony Component	B	Moderate	Poor	Severe
Shallow Component	D	High	Poor	Severe

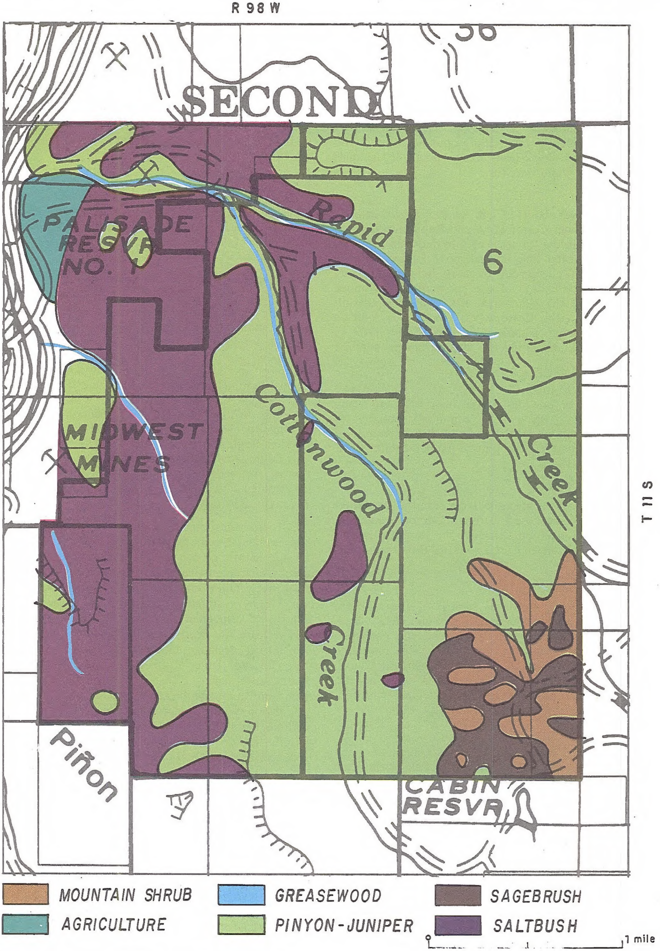
Note: Adapted from U.S. Dept. of Agriculture, Soil Conservation Service (Grand Junction, Colo.), Mesa County Area Soil Survey, unpublished.

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic and soil conditions which produce extreme surface erosion or landslide hazards.



Map MB2-1. Vegetative types in the area of the proposed Cottonwood No. 1 and No. 2 mines

deer population estimates are based on average numbers. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer population within the Cottonwood Creek lease area of about 455 animals during the winter months.

ELK

The lower limit of elk winter range extends midway down Cottonwood and Rapid creeks (map MB2-2). Elk use the lease area in midwinter only in years of greater than normal snow depths at higher elevations. Pellet group transects indicate an average of 1.6 elk days of use per acre in the upper portions of the lease area. Elk winter population estimates in the Cottonwood Creek area indicate about 8 elk per square mile. This would result in about 8 elk inhabiting the site during an average winter.

BLACK BEAR

The upper portions of the lease area are black bear habitat. Black bear commonly wander to lower elevations in the early spring in search of food and may use the pinyon-juniper habitat type. (See map MB2-2.)

MOUNTAIN LION

Mountain lions are expected to use the lease tract occasionally because the rough canyons, isolation, and winter deer population offer excellent mountain lion habitat and food sources. (See map MB2-2.)

Small Mammals

Species composition is typical of the saltbush, sagebrush, pinyon-juniper, and mountain shrub habitat types. Common species include cottontail rabbits, rock squirrels, wood rats, Colorado and least chipmunks, mice, coyotes, and striped skunks. Small mammals closely associated with aquatic habitat, such as beaver, muskrat, and raccoon, occur along the Colorado River.

Game Birds

Mourning doves are the most common game birds occurring throughout the area during the summer months. Chukars are also found throughout the area, most frequently using rocky slopes and patches of annual cheatgrass. On the higher ridges of the lease area, blue grouse can be found in the summer in the mountain shrub type. A small population of turkey occasionally utilizes the upper portions of the lease area during the winter period. Gambel quail occur in the general vicinity, utilizing brushy thickets adjacent to fruit orchards and along the Colorado River and Rapid Creek.

Mallards and Canadian geese nest and raise their young along the Colorado River in DeBeque Canyon. During spring and fall migration and the winter months, a much greater variety of waterfowl is present on the river, with the common merganser and common goldeneye two of the most abundant species.

Other Birds

The rocky cliffs on the lease area provide several miles of suitable raptor nesting habitat. No active nests have been identified, but active golden eagle and prairie falcon aeries are in DeBeque Canyon and around Grand Mesa.

Endangered or Threatened Species

Bald eagles are commonly seen along the Colorado River in DeBeque Canyon throughout the winter months. Birds are frequently observed on hunting forays along the river or perched in cottonwood trees. This lease area, including mine buildings and loadout facilities, is also within the normal hunting range of the peregrine falcon aerie in DeBeque Canyon. Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle. (See map MB2-2.)

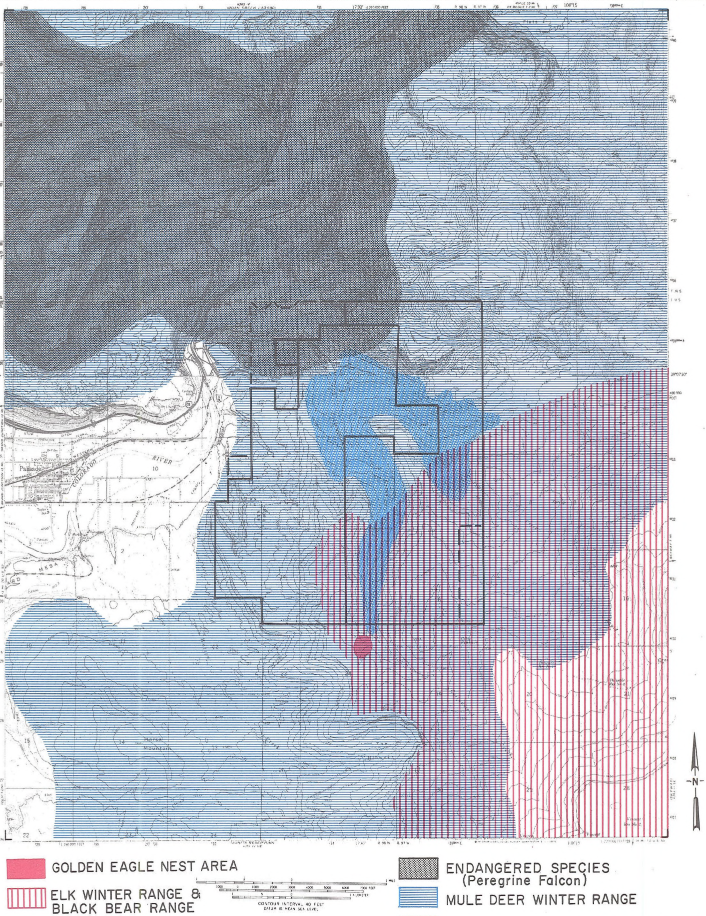
Aquatic Biology

All drainages on the Cottonwood Creek lease site contain intermittent streams; thus, there is no aquatic habitat on the site. Cottonwood and Rapid creeks characteristically flow only during significant precipitation events. Runoff water is typically very high in sulfates, carbonates, total dissolved solids, and suspended sediments.

The lease site is adjacent to the Colorado River and all site drainage enters directly into the river. The Colorado River at this location is considered a warm-water fishery. Channel catfish, large mouth bass, sunfish and bullheads dominate the game fish population while numerous nongame fish species including roundtail chub, sand shiner, carp, flannelmouth sucker, bluehead sucker, speckled dace, redfin shiner, carp and others are found here.

Endangered or Threatened Species

From below the confluence of Plateau Creek, this section of the Colorado River is habitat for three species of threatened and endangered fish. The Colorado squawfish, the razorback sucker, and the humpback chub are presently known to exist in the river directly adjacent to the mine area. The U.S. Fish and Wildlife Service has recommended this section of river as critical habitat for the Colorado squawfish (see Aquatic Biology, chapter 2, regional analysis).



Map MB2-2. Wildlife ranges in the area of the proposed Cottonwood No. 1 and No. 2 mines: deer, elk, bear, golden eagle, endangered species

Cultural Resources

Archeological Resources

An inventory was performed on a series of drill holes for the Cottonwood Creek site (Connors 1976). No archeological values were located.

Areas undergoing surface disturbance are contained within a saltbush/barren vegetation zone (see map MB2-1 showing vegetation types on the Cottonwood Creek site). As part of the regional predictability model (see appendix D), the archeological inventory in saltbush domnated zones suggests a probable site density of 1.3 sites per section (Hibbets 1978). Although site density is expected to be low, no conclusive statement can be made until the predictability model is completed; the final report is due December 15, 1978.

Sixteen sites have been located within three sections of the lease area in association with pinyon-juniper zones (Hibbets 1978). While these sites should remain outside the area of direct impact, they serve as a strong indicator of prehistoric use in the area.

Historical Resources

The Cottonwood Creek site has not been formally inventoried, but a survey is planned. This site contains three small mines that date from 1908 (Grand Veiw Mine). Because these mines were of a later development period (1908-1940) along the Little Bookcliffs, they are not of any significant historic value.

Transportation

Highways

The closest highway to the proposed Cottonwood Creek mine is I-70, the major route between Denver and Los Angeles. At present the completed sections of the road are operating much below capacity. Average daily traffic in the Cameo area is 5,550 vehicles. U.S. 6 parallels I-70 through the populated area but passes through the towns.

Railroads

The mainline of the Denver and Rio Grande Western Railroad passes near the Cottonwood mine site and lies parallel to I-70 in this area. The railroad serves mines currently operating in the Cameo area. Loading facilities are under construction north of the Cameo power plant.

Airports

Walker Field near Grand Junction is the closest airport to the proposed mine. It is served daily by Frontier and United airlines. This is the major airport in Western Colorado.

Livestock

The coal lease tract is currently part of the Cottonwood-Rapid Creek and Lloyd grazing allotments, both of which consist totally of public land. The grazing rights are leased to W.R. Lloyd, who grazes 108 cattle between April 15 and May 15, and 20 cattle between May 16 and October 31, which is equivalent to 218 animal unit months (AUMs) per year. This is below the total of 278 AUMs of forage annually produced on the allotments. Only 3,153 of the 5,785 acres in these two allotments are grazeable by livestock; the rest are inaccessible because of steepness or unavailability of water. The 3,153 usable acres are overutilized by both livestock and wildlife.

Recreation

The public lands of the Cottonwood Creek lease site are not used for recreation because there is no legal public access. Roads through the lease site provide BLM management access and access to several reservoirs controlled by the city of Palisade for its water supply; however, the public is not permitted to use the reservoirs.

The lease site is located within Big Game Management Unit 30, which provided 3,364 recreation days in 1976, and Small Game Management Unit 60, which provided 8,529 recreation days in 1975. Tables MB2-4 and MB2-5 list hunter days by species and game management unit. Cottonwood and Rapid creeks, which run through the lease site, are intermittent streams and provide no fisheries value (see Aquatic Biology).

The Colorado Division of Parks and Outdoor Recreation manages the Island Acres Recreation Area, which is located on the Colorado River about 1 mile upstream from Mid-Continent's proposed coal train loading facility. Island Acres provides opportunities for camping, picnicking, and swimming. The area provided recreation for 102,578 visitors from July 1976 to June 1977 (Colorado Division of Parks and Outdoor Recreation 1977.)

Most of the population increase due to mining activity at the Cottonwood Creek site would occur in the Grand Junction-Palisade area. Grand Junction provides city-sponsored leagues for softball, basketball, and volleyball. The city's facilities include eleven parks, fourteen swimming pools, and sixteen tennis courts. The Grand Junction Recreation Department feels that use of its facilities is now maximum; people have to be turned away from the programs, especially league activities. The department also states that only 40 percent of this use is from city residents, which indicates that the city's programs are a major recreation outlet for the surrounding area. The city of Palisade provides

TABLE MB2-4

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 41

	Deer	Elk	Bear	Mountain Lion	Total
Hunters	894	818	31	-	a/
Recreation days b/	3,803	4,091	176	3	8,073

Source: Colorado Division of Wildlife, 1976 Big Game Harvest.

a/ Hunter totals are not included because hunting and trapping of more than one species are allowed.

b/ All or part of a day.

TABLE MB2-5

SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 60

	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	111	589	Badgers	3	246
Geese	75	295	Beavers	2	43
Doves and pigeons	160	512	Bobcats	7	202
Pheasants	317	1,297	Ringtailed cats	2	189
Quails	78	190	Coyotes	9	375
Chukars	98	312	Muskrats	5	157
Grouse	104	240	Raccoons	5	203
Rabbits	488	2,822	Skunks	7	519
Coyotes	77	268			
Prairie dogs	36	70			
Total	b/	6,595		b/	1,934

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

a park with a playground, two tennis courts, and a basketball court.

For a comprehensive look at the recreational resources of the region refer to chapter 2 of the regional analysis, Recreation.

Visual Resources

A series of terraces and buttes serves as the transition between the Colorado River (elevation 4,700 feet) and the rim of Grand Mesa (elevation 6,400 feet). The vertical elements of these geologic formations are steep taluses and rock cliffs showing horizontal rock strata that form the base of Grand Mesa. The edges of the terraces and rock strata establish a strong linear pattern in the landscape (see figure MB2-3). Red and tan rock colors emphasize this pattern and are augmented by sharp shadow patterns during the day. The contrast of the cliff faces and flatter terraces extending in a 1,700-foot ascent to Grand Mesa creates a dramatic landscape that is visually dominated by a landform which has been eroded into a rough texture of dissected valleys and flat topped buttes. The west-facing slopes have a pinyon-juniper and mountain brush vegetative cover which adds a multi-colored, spotty texture to the land surface.

There is an intermixed pattern of land use in the vicinity of the proposed Mid-Continent facility. Residences, roads, agricultural buildings, orchards, and cultivated fields have moderately altered the natural landscape, but these cultural modifications are visually dominated by the background cliffs and terraces.

The exposed cliff faces and the diverse vegetative community, which are both visible from I-70, have resulted in a visual resource management (VRM) Class II (see appendix F for VRM methodology description) for the I-70 corridor adjacent to the proposed site. The proposed facility area is rated as a Class IV, which represents the lowered public sensitivity to landscape changes because of restricted visual access to this area.

The landscape character of the southern extremity of DeBeque Canyon verges on rural-industrial. The predominantly agricultural and residential land use is not visually disruptive. Added to this land use pattern, however, are the more intensive industrial developments of the Roadside Mine, Cameo Power Plant, the D&RGW Railroad, power lines, commercial areas, and the four-lane highway.

Socioeconomic Conditions

Demography

Table MB2-6 lists the population for each incorporated town and each county census area within Mesa County and western Garfield County, for the 1970 and 1977 censuses. Grand Junction and vicinity is the most heavily populated community between the Denver and Salt Lake City metropolitan areas. As such, it serves as a regional center of commercial and industrial activity for most of western Colorado and eastern Utah. Recent growth in the Grand Junction area has been caused by a variety of economic factors, including the expectation that the area's mineral resources will develop rapidly in the near future. Corporations and government agencies involved in mineral resource development over a wide area have located regional headquarters in Grand Junction. Table MB2-6 indicates that most areas around Grand Junction have grown at a moderate rate, averaging between 3 and 5 percent per year since 1970.

The median age of the population in Mesa County is higher, but not significantly higher, than the Colorado median age of 26.2 years. The Palisade area has a relatively older population than the rest of the county, and a much higher concentration of persons over 65 years of age.

The small communities of DeBeque, Collbran, and Grand Valley are similar in size, and all contain a population whose median age is higher than the Colorado median. Collbran is somewhat different from most communities in western Colorado in that the median age of its population increased between 1970 and 1977. The DeBeque and Grand Valley areas have experienced growth due to the location of the Occidential Oil Shale test site outside of DeBeque and the Paraho Oil Shale site east of Grand Valley.

Community Attitudes and Lifestyles

According to the Mesa County Development Department, a majority of the new residents in the Grand Junction area moved there because they liked it as a place to live. The Grand Junction area is more urban than most other areas of western Colorado, but it is still small enough to retain attributes of small town living. Residents place a high value on the casual atmosphere and lack of congestion associated with life in Grand Junction. However, there is also a desire to attract economic growth to the area and improve job opportunities for residents.

As a population center, Grand Junction provides its residents opportunities not available in most other communities in western Colorado. Mesa College offers courses of study in many subject areas, college athletic events, and dramatic performances. There is a larger selection of stores, restaurants, and movie theatres than in other towns. Airline and bus service to metropolitan areas is regularly available, and an interstate highway links Grand Junction to Denver and Salt Lake City.

Community attitudes towards growth and development were documented in a survey conducted

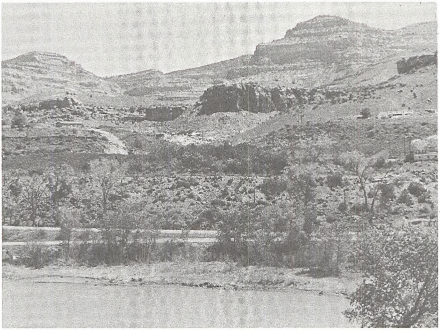


Figure MB2-3. The terrace features at the Cottonwood site establish a line pattern in the DeBeque Canyon landscape.

by Bickert, Brown, Coddington, and Associates, Inc., in July 1973. Results of that survey are discussed in the regional volume.

Community Facilities

Most of the developed areas around Grand Junction receive water from the Ute Water Conservancy District, which provides water to other districts and to individuals. The district is currently developing additional water resources. There are many special districts in the county providing various services including water, sewer, fire protection, pest control, hospital services, cemetary services, and flood control. There are two sanitary landfills in the county. Police service outside of town is provided by the county sheriff.

Grand Junction, Fruita, Collbran, Palisade, and DeBeque are improving or plan to improve their water and sewage treatment systems. More detailed information about facilities in the county is included in the regional volume.

Housing

Table MB2-7 lists the housing units available in Mesa County and western Garfield County, according to the 1977 special population censuses. The total housing stock in Garfield County increased by 22 percent between 1970 and 1976. About 40 percent of that increase was mobile homes.

The Colorado Division of Housing (1976) estimates that there was a total of 24,914 housing units in Mesa County in April 1976, an increase of 6,116 units (or 32 percent) from 1970. Over one-third of the total increase in housing stock was mobile home units. In recent years, duplexes and multi-family units have constituted about 30 percent of the new housing starts. High prices for single-family dwellings and the unavailability of rental units are contributing to an increase in multi-family and mobile home units throughout the county. The county has an above average need for low to moderate income housing, because (1) the median family income is more than $3,000 less than the state median and (2) Mesa County has an above average number of elderly persons.

Education

Education in the areas around the Coal Canyon mine is provided by four public school districts: Mesa County Valley School District 51, DeBeque School District RE49(JT), Plateau Valley School District 50, and Grand Valley School District 16. Mesa County Valley is by far the largest with 96 percent of the combined enrollment. In general, the school districts all have some excess capacity to absorb new students. Mesa County Valley has some problem with capacity of its junior high schools but plans to expand in the future. Table MB2-8 summarizes the situations of the four districts.

Health Care

The level of health care services in and around Grand Junction is the highest in the ES area. The four hospitals located in Grand Junction provide specialized services to much of western Colorado. In addition, the Fruita area is served by a small hospital located in town. There are more physicians located in Grand Junction than in the remainder of the ES area combined. Many of these physicians are specialists, who provide their services to patients from a wide area. Amblance services to the area is good; both Fruita and Grand Junction operate ambulance services connected with their fire departments.

Mental health services are provided to the area by the Colorado West Regional Mental Health Center, which is headquartered at Glenwood Springs but has offices in Grand Junction.

The Mesa County Department of Public Health has a staff of six public health nurses who provide generalized health eduction and preventative health services in addition to specialized activities in tuberculosis control, mental retardation, venereal disease, and handicapped children's programs.

Health care in eastern Mesa County is limited. Collbran supports the Plateau Valley Hospital and Nursing Home. The hospital has six beds, three of which conform to federal standards. The nursing home has thirteen long-term care beds. A single doctor provides most of the service to patients in the Collbran area.

DeBeque and Grand Valley have no health care facilities in town. The nearest doctor for DeBeque residents is in Palisade, 22 miles away, and hospital care is available in Grand Junction. The closest physicians and hospital for Grand Valley residents are in Rifle, about 16 miles away.

Employment

In Mesa County, where most of Cottonwood Creek's employees would live, employment grew at an annual rate of 6.1 percent between 1973 and 1976. The total number of persons employed increased from 24,030 to 28,622 during this period. As shown in table MB2-9 the increase was all in nonagricultural employment; agricultural employment declined by 11.6 percent. A comparison of employment by sector shows that all sectors showed some growth, but the mining, the transportation, the finance, insurance, and real estate, and the contract construction sectors had the largest percentage increases. The increase of 130 percent in mining employment can be attributed to new mining activity in the Uravan uranium belt and coal mining in western Garfield County. Oil shale test projects near DeBeque and Grand Valley have

TABLE MB2-6

POPULATION STATISTICS

	1970 Population	1977 Population	Percent Change 1970-1977	Median Age-1970 (Years)	Median Age-1977 (Years)	Percent Population Over 65 Years
Mesa County:	54,374	66,848	+ 23	30.2	29.4	+ 11
Clifton area	3,554	5,913	+ 66	30.2	26.8	+ 9
Fruita	1,822	2,328	+280	34.1	28.5	+ 15
Fruita area	5,837	7,709	+ 32	29.4	28.4	+ 10
Grand Junction	24,043	25,398	+ 5	32.1	30.2	+ 15
Grand Junction area	28,527	35,871	+ 26	30.0	29.3	+ 13
Orchard Mesa area	6,890	5,012	- 27	28.6	29.6	+ 8
Palisade	874	1,038	+ 19	-	46.9	+ 31
Palisade area	1,964	2,178	+ 10	41.8	38.8	+ 21
Redlands area	4,446	6,826	+ 53	29.9	30.6	+ 6
Whitewater area	605	751	+ 24	36.1	32.6	+ 12
Collbran	225	293	+ 30	-	36.9	+ 20
Collbran area	1,428	1,364	- 4	31.4	33.6	+ 14
DeBeque	155	264	+ 70	-	32.5	+ 14
DeBeque area	306	427	+ 40	42.1	33.5	+ 14
Garfield County:						
Grand Valley	270	377	+ 40	-	30.0	+ 18
Grand Valley area	819	858	+ 5	32.1	30.9	+ 14

Source: U.S. Bureau of the Census, 1970 Population Census and 1977 Special Census for Mesa and Garfield Counties.

TABLE MB2-7

EXISTING HOUSING IN PROPOSED ACTION AREA

County	Total Housing Units	
	Occupied	Vacant
Mesa County:		
Collbran	119	13
DeBeque	100	11
Fruita	788	41
Grand Junction	10,129	596
Palisade	418	23
Unincorporated areas	12,321	759
Garfield County:		
Grand Valley	138	19

Source: U.S. Bureau of the Census, Special Population Census for Mesa and Garfield Counties, 1977.

TABLE MB2-8

CHARACTERISTICS OF AFFECTED SCHOOL DISTRICTS

School District	1977 Enrollment	Schools	Design Capacity	Excess Capacity	Teachers	Student: Teacher Ratio	Bonding Capacity (dollars)	Outstanding Debt (dollars)
Mesa County Valley (51)	14,025	30	15,561	1,536	678	20:1	32,043,730	2,500,000
DeBeque (RE49(JT))	160	2	195	35	16	11:1	260,000	130,000
Plateau Valley (50)	284	3	350	66	14	20:1	1,200,000	19,000
Grand Valley (16)	180	1	250	70	17	10:1	800,000	184,000

TABLE MB2-9

GROWTH OF EMPLOYMENT BY SECTOR
IN MESA COUNTY, 1973-1976

Sector	1973	1976	Increase	Percent Change
Agriculture	3,030	1,790	- 240	- 11.8
Mining	390	900	+ 510	+ 130.8
Contract Construction	1,330	1,730	+ 400	+ 30.1
Manufacturing	2,280	2,440	+ 160	+ 7.0
Transportation	1,420	1,680	+ 460	+ 32.4
Wholesale and Retail Trade	5,040	5,710	+ 670	+ 13.3
Finance, Insurance, and Real Estate	630	820	+ 190	+ 30.2
Service	3,420	4,410	+ 990	+ 28.9
Government	4,140	4,470	+ 330	+ 8.0

Source: Colorado Division of Employment, Research and Analysis, February 1977.

Note: This information does not include self-employed workers, other than in agriculture, unpaid family, and domestic workers.

also added to employment in the mining sector. In terms of number of employees, the service trade and mining sectors showed the greatest increase.

Table MB2-9 also shows that the trade, service, and government sectors are the largest employers in the Mesa County economy and that, in spite of the fast growth rate, the finance, insurance, and real estate sector and the mining sector are the smallest. The sectors with the largest employment in Garfield County are also trade, services, and government. Almost all sectors have grown since 1970.

The regional volume gives more detail about employment in Mesa and Garfield counties. Employment data for specific towns and cities are not available.

Income

The proposed Cottonwood Creek property is located in Mesa County, 2.5 miles east of the town of Palisade. According to the U. S. Department of Commerce (1974), 1974 per capita income in Palisade was $4,324. This was substantially below the county average of $4,799, which in turn was lower than the Colorado average of $4,514. Mesa county ranked fourth in the seven-county ES area.

Median family income in Mesa County was estimated to be $11,130, third highest in the region but lower than state and national averages. In 1975, 11.4 percent of the families in the county had incomes below the poverty level.

In 1974, government (21.0 percent) and wholesale and retail trade (20.6 percent) were the largest sources of personal income. Other sectors and the share they produced were services, 15.7 percent; contract construction, 10.2 percent; transportation, communication, and public utilities, 9.9 percent; manufacturing, 8.9 percent; agriculture, 6.9 percent; finance, insurance, and real estate, 3.6 percent; mining, 3.3 percent; and other industries, 0.4 percent. This breakdown indicates the importance of the trade sector in the economy of the county and the role of Grand Junction as a regional center. For a discussion of regional incomes, see the income section in the regional volume.

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describe the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceeding sections of chapter 2 which are expected to change in the future: air quality, water resources, vegetation, wildlife, archeological resources, livestock, recreation, and socioeconomic conditions.

Air Quality

Future air quality without the proposed mine at Cottonwood Creek should deteriorate slightly compared with current air quality. The impact of Roadside Mine and the power plant should already be included in measured concentrations. There are two other mines, Cameo and Coal Canyon, proposed within this same geographic area. Ambient concentrations may increase as a result of these new sources.

Water Resources

Mid-Continent Coal and Coke Company will mine coal on private land north of the Cottonwood Creek site. In addition, Mid-Continent may develop adjacent private coal reserves even without the proposed action. Therefore, some impact to water resources could occur as a result of this private development in the future. The extent of this impact cannot be evaluated because detailed information on possible mining of the private coal is not available. Otherwise there should be no change in the water resources.

Vegetation

Without the proposed action, the vegetation would remain in its present undisturbed state, with the exception of approximately 15 acres which would be disturbed by the construction of seven reservoirs, four water catchments, 2.6 miles of access road, and 1 mile of stock trail as part of a proposed allotment management plan (AMP). Implementation of the proposed AMP (see Livestock) may improve the vegetative condition of the coal lease area by increasing the density of key species (western wheatgrass, galleta grass, and big sagebrush). The primary use of the vegetation would remain livestock and wildlife forage.

Wildlife

Wildlife use of the area would not change through 1990 unless the reservoirs, catchments, and livestock grazing system are implemented (see Livestock). If they are implemented, wildlife (primarily big game) use could increase due to improved water distributuion, better forage, and less competition with livestock.

Archeological Resources

Through the year 1990, vandalism and erosion would be the two major factors causing the loss of archeological values. It is doubtful that additional monies or employees would be available to retard this loss, although the Federal Land Policy and Management Act of 1976 will provide BLM with more protective enforcement authority. The down-

ward trend is expected to continue or accelerate under the present land use management program.

Livestock

The grazing system on the Cottonwood Creek and Lloyd allotments would be considerably changed as a result of a new allotment management plan (AMP) that has been proposed to alleviate overgrazing by livestock. The AMP would combine the Lloyd and Cottonwood-Rapid Creek allotments into the Lloyd allotment, which would be divided into an upper pasture on the east and a lower pasture on the west. The number of cattle run on the allotment would be decreased from 128 to 86, but the cattle would be kept on the allotment a longer period of time; therefore, the total AUMs of forage would remain 278.

A rest-rotation grazing treatment would be adopted. Each pasture would be placed on a three-year cycle of spring grazing, fall grazing, and rest. The spring grazing would be treatment A, consisting of 40 cattle grazed between April 15 and July 30. Treatment B would consist of grazing 46 cattle between August 1 and October 31. Treatment C would be no cattle grazing or resting the range. This sequence of treatments would result in maximum livestock production, along with increased plant density, vigor, and litter, and an accompanying increase in soil fertility and slowing in soil erosion.

Seven reservoirs, four water catchments, 1 mile of stock trail, 0.8 mile of fence, and 2.6 miles of access road are proposed to implement the grazing system described above. The reservoirs and water catchments would distribute the cattle more evenly over the waterless areas of the allotment, particularly the dry ridges. The roads and stock trails would provide access for livestock and people.

Recreation

The BLM has identified a need for public access to the public lands east of Palisade. The Whitewater MFP recommends developing limited access to the area up to the confluence of Cottonwood and Rapid creeks and from the community of Mesa. (Refer to map 19 in appendix A for location of the public lands and access routes.) The public lands could provide dispersed recreation, such as hunting, hiking, and wildlife viewing. Wildlife in the area include mule deer, cottontail rabbits, and chukars (see Wildlife).

The proposed U.S. Bureau of Reclamation (USBR) Dominguez Dam, just south of Grand Junction, (see figure MB2-4) would provide water-based recreation such as boating, fishing, and hiking. The USBR estimates that the dam could provide 300,000 to 500,000 recreation days in its first year of use which would help relieve some of the projected need for this type of recreation identified by the 1976 Colorado Comprehensive Outdoor Recreation Plan (see Regional Anylsis, chapter 2, Recreation).

Growth in Mesa County would increase by 34,700 people from 1977 to 1990, which would require 114 acres of additional community active/improved park land (e.g. ballfields, playgrounds, tennis courts) to prevent overuse and deterioration of existing facilities (Bickert, Browne, Coddington, and Associates, Inc., 1977).

Socioeconomic Conditions

Population of Mesa County is expected to grow at a rapid rate to 110,700 people in 1990. Development of oil shale and uranium and the area's role as a regional center account for the growth. The Grand Junction area will become more urbanized, resulting in the continued decline in the importance of agriculture in the local economy. Incomes are expected to be higher.

Garfield County is projected to grow at a rapid rate, to 45,258 people in 1990, primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale development.

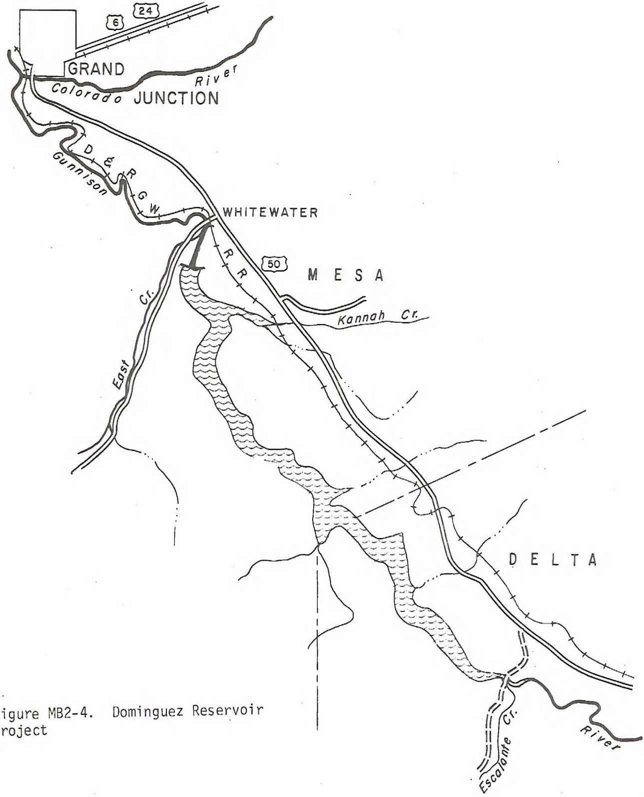


Figure MB2-4. Dominguez Reservoir project

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review prior to promulgation of initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), and it does not fully reflect the requirements of the initial regulations. However, in this ES the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial regulations. The Department of the Interior will not approve the M&R plan until Mid-Continent Coal and Coke Company has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Cottonwood Creek mine include conveyors, transfer points, open storage piles, haul roads for coal and refuse, employee traffic on mine access roads, and wind erosion of refuse piles and other exposed areas at the mine. A common source of fugitive dust at underground mines that is not projected for the Cottonwood Creek mine is crushing and sizing at the preparation plant. These operations should produce negligible emissions because a wet process will be used.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution-producing operation, (2) multiply that activity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Cottonwood Creek mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division and a recent study of emissions from mining (Colorado APCD 1978, Axetell 1978).

Table MB3-A presents estimates of fugitive dust emissions at the Cottonwood Creek site from each of the identified sources in 1985, 1990, and 2110 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The estimates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table MB3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Cottonwood Creek site other than fugitive dust sources were exhaust emissions from diesel-powered haul trucks and employees' motor vehicles on mine access roads. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table MB3-B. These emissions are based upon rates per mile of travel (emission factors) which will decrease between 1985 and subsequent study years. In the case of Cottonwood Creek, the reduced emis-

sion rates partially offset increased activity rates projected when the mine is at full production in 1990. These emissions are from both employee travel on the mine site and haul trucks.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the canyon or valley near where mining emissions occur. The site specific meteorological data reflected the prevalence of transport of the pollutants up and down the canyon from the mine. Because of the greater influence of the canyon on maximum concentrations near the mine, a separate model which considers reflection of the plume was used to predict maximum 24-hour concentrations. This short-term model is described in the following section.

The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes. Predicted concentrations are usually accurate within a factor of three.

Since there are no wind data available for the lower DeBeque Canyon area (see chapter 2), the wind and stability data required for the model were obtained by modifying that from Grand Junction airport to reflect orientation of DeBeque Canyon. This wind rose was previously shown in figure MB2-A. Emission data were presented in table MB3-A.

Predicted increases in ambient concentrations resulting from Cottonwood Creek's operation in 1990 are shown on map MB3-A. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 20 micrograms per cubic meter ($\mu g/m^3$) in a small area along the coal haul road just west of the mine boundary. Concentrations are predicted to increase by 10 $\mu g/m^3$ for a distance of about 1 mile from the surface facilities and along the haul road north toward Cameo. Predicted impact in 1985 is about half that of 1990 but is shown to occur in the same areas. (Map MB3-B depicts cumulative concentrations from all of the proposed actions in the Debeque Canyon area, i.e., Mid-Continent: Coal Canyon mine and Cottonwood Creek No. 1 and No. 2 mines, and Cameo No. 1 and No. 2 mines.) The modeling results indicate that emissions would not cause significant increases in annual average concentrations outside the canyon area.

The predicted impact of the mine is less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. Off site, it is also less than the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD), although coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

The dispersion model used to predict maximum 24-hour particulate concentrations assumed Gaussian distribution of particulates away from the plume centerline, a constant wind direction, and complete reflection of the plume off both canyon walls. The basic dispersion equation is described in detail in *Workbook of Atmospheric Dispersion Estimates* (Turner 1970). The fallout function was not incorporated in the short-term model.

Several locations (receptors) up and down DeBeque Canyon from Cottonwood Creek were specified in the model for prediction of ground-level concentrations. At each receptor, the contribution caused by each emission source at Cottonwood Creek was calculated separately; individual source contributions were summed to determine the total concentration at the receptor resulting from the mining operations.

Wind data from the Mt. Logan-Mt. Callahan reach of DeBeque Canyon (see chapter 2) indicated that winds blew from the south-southwest, or up canyon, for all 24 hours on five different days in

one year and from the north-northeast, or down canyon, on two entire days. These time periods were assumed to produce the highest concentrations since downwind receptors would be in the plume continuously. From these 24-hour periods, the two days (one with south winds and one with north winds) with the lowest average wind speeds and most stable atmospheric conditions provided the meteorological input for modeling.

The annual average emission rates were also used to predict maximum concentrations because no information was available on seasonal variations in production. Although it is expected that emission rates will vary somewhat throughout the year, the sources at Cottonwood Creek mine are not subject to great increases in emissions due to equipment malfunction or high wind speeds. Also, increased emissions at different sources would occur independently rather than simultaneously and would probably not occur at the same time as the most adverse meteorological conditions.

Predicted maximum concentrations from the mine in 1990 are shown on map MB3-C. With winds from the north, a maximum concentration of about 100 $\mu g/m^3$ is projected to occur just west of the surface facilities. The impact from Cottonwood Creek mine would extend well out into the Grand Valley (at least 5 miles). With winds from the south, the maximum concentration is predicted to be 85 $\mu g/m^3$. These concentrations are less than the 24-hour primary air quality standard of 260 $\mu g/m^3$ and the secondary standard of 150 $\mu g/m^3$, and the very high concentrations are projected to occur only in the immediate vicinity of the mine. The maximum 24-hour concentration in 1985 would be 49 $\mu g/m^3$.

Because the short-term dispersion model involves prediction of extreme conditions for meteorology and emission rates, it is probably slightly less accurate than the annual model.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine will reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west central Colorado has been empirically determined by Ettinger and Royer (1972); it is shown if figure MB3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due to precipitation. Therefore, the equation is more likely to predict visual range over an averaging

TABLE MB3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED COTTONWOOD CREEK MINE SITE

Emission source	Emissions, ton/yr 1985	Emissions, ton/yr 1990 & EML
Conveyor - 2 sections	3.9	9.8
Transfer points - 1 point	5.8	14.6
Preparation plant - wet process	neg	neg
Truck loadout	neg	0.1
Open storage - raw coal	10.1	10.1
- surge pile	6.7	6.7
Haul roads - clean coal	124.0	310.0
- refuse	2.4	6.1
Access roads	25.5	50.9
Exposed areas - refuse	6.8	6.8
- mine facilities	2.2	2.2
TOTAL	187.4	417.3

TABLE MB3-B

EMISSIONS OF GASEOUS POLLUTANTS FROM THE PROPOSED COTTONWOOD CREEK MINE SITE

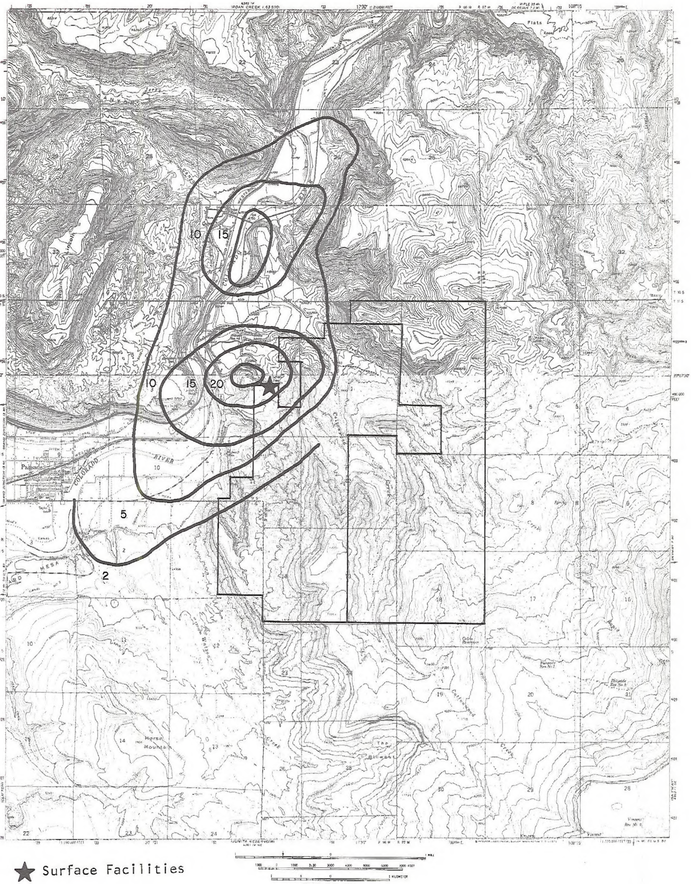
Year	Total emissions from vehicles, ton/yr CO	HC	NO_x	SO_x
1985	5.4	0.5	1.8	0.4
1990	7.5	0.8	2.0	1.0

$$L_v = \frac{24}{0.2 + 0.007\,M}\text{, where}$$

L_v = Average visual range, miles

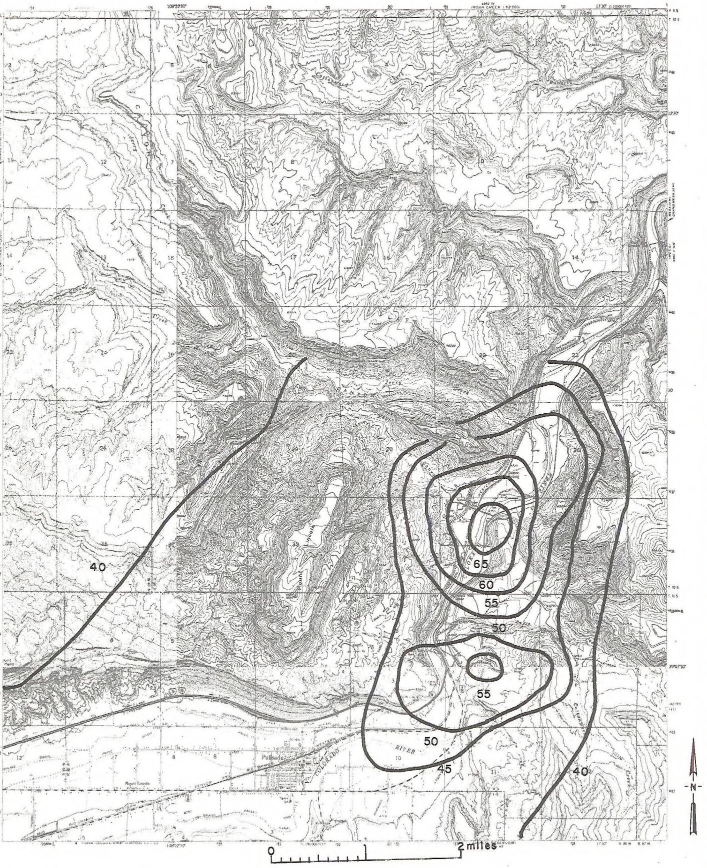
M = Average particulate concentration (micrograms per cubic meter)

Figure MB3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).

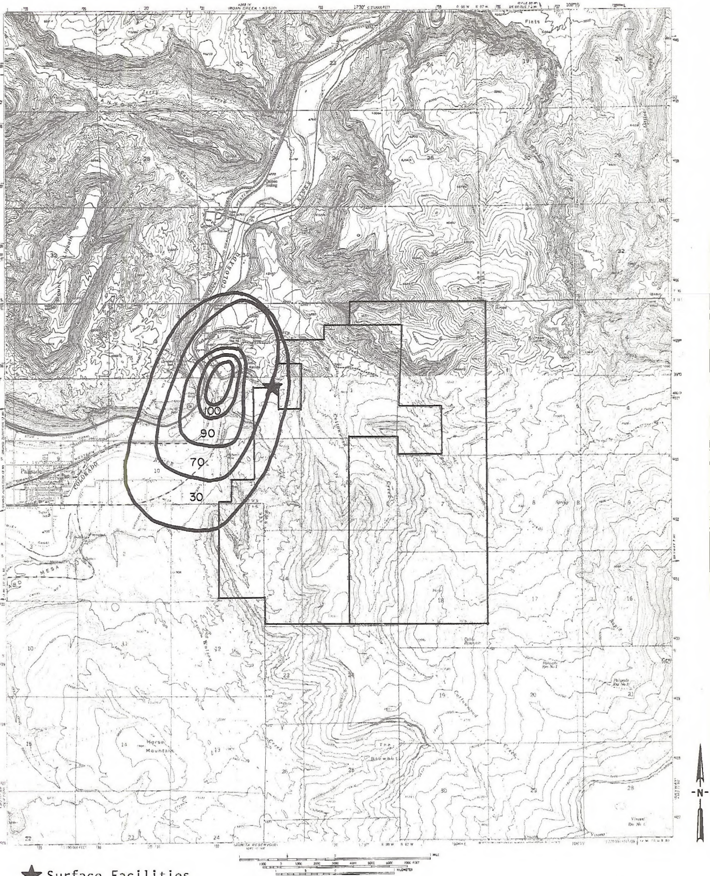


★ Surface Facilities

Map MB3-A. Predicted increases in ambient concentrations in 1990 (micrograms per cubic meter)



Map MB3-B. Cumulative concentrations from proposed actions in the DeBeque Canyon area (micrograms per cubic meter)



★ Surface Facilities

Map MB3-C. Predicted maximum 24-hour concentrations in 1990 (micrograms per cubic meter)

period of a year than for a short-term period such as 24 hours.

As indicated on map MB3-A, particulate concentrations in 1990 would be increased to a distance of at least 3 miles from the surface facilities. Along a line of sight from the main mine buildings to the north or southwest, concentrations would be increased an average of about 9.5 $\mu g/m^3$ over this 3 mile distance. Using the equation above and a background particulate concentration of 42 $\mu g/m^3$, the estimated reduction in visual range on the mine site as a result of mining emissions would be about 6 miles on an annual basis. Because of the limited area of air quality impact, average visibility would probably only be affected at the extreme eastern end of the Grand Valley. Visibility reductions in 1985 would be about half of those predicted for 1990.

Geologic and Geographic Setting

Topography

Impacts to the topography of the Cottonwood Creek mine property would be minimal. Three aspects of the mining operation would introduce alterations of the existing topography: excavation and earthmoving associated with construction of surface facilities; long-term use of the refuse disposal area; and surface subsidence.

The excavation and earthmoving in preparation for construction of surface facilities would alter the existing topography of 61 acres (or 1 percent) of the surface topography of the mine site. In the area where most disturbance would occur for construction of mine offices, bathhouses, warehouses, etc., natural slopes average approximately 12 percent (or 7 degrees). The area designated for refuse disposal varies from 5 percent to 25 percent (or 3 degrees to 14 degrees). No information concerning the projected topography for the 25 to 100 year mine life was provided. However, benching, grading, and leveling would be required. In addition, some areas could require blasting and cliff sealing. Level surfaces and cut-and-fill slopes would replace the natural steep slopes. The modified surfaces would alter the drainage characteristics of the area, and both erosion and runoff could increase. In addition, noise and vibration would add to the landslide and rockslide potential of the area. (See Soils for further discussion.)

Long-term use of the refuse disposal area would gradually alter the surface topography of 31 acres (or 0.6 percent) of the mine property. (Note: these 31 acres are included in the 61 acres above). Natural topography is discussed above for the site. No information concerning the projected final topography of the area has been provided by the company. The company has stated that 300,000 tons of mine refuse would be deposited at the refuse disposal site annually. At this time, it is possible to predict only that the surface elevation of the area would be raised.

A more significant impact of the proposed mining operation would be surface subsidence. A total of 5,040 acres (or 91 percent) could be subject to surface subsidence. The *Subsidence Engineer's Handbook* predicts a maximum of 12 feet of surface subsidence on the mine property. Subsidence in most areas could be significantly less. Surface subsidence could induce open fractures, broken surfaces, and hummocky terrain over the surface. This subsidence may change the drainage characteristics of the area; small changes in the water table and in water courses could occur. In addition, erosion and sedimentation from the area could increase.

Three subsidence profiles were computed for areas which could be particularly vulnerable to the effects of subsidence. These were areas underlying Cabin Reservoir, and the water collection and storage facilities of the town of Palisade. These profiles indicate that because of Cabin Reservoir's distance from the area to be mined, no subsidence can be predicted within 100 feet of the dam and no strain should result to the dam. However, drainage characteristics of the upstream area could be changed.

Due to the shallow overburden present on the northern boundary of the lease area, subsidence could affect the area. A maximum of 12 feet of surface subsidence could occur in the area. This maximum subsidence is predicted for the center of the longwall panel with subsidence decreasing as the distance from the center of the longwall panel increases. Surface strain resulting from subsidence would be significant to building and pipelines in the area. Pipelines without angling and telescoping joints would fracture and rupture as the surface subsides.

No subsidence has been reported in the area from mine workings which have existed since the early 1900s. The lack of subsidence would be attributable to a 25- to 30-foot resistant 'beam' or sandstone bed 40 feet above the Cameo seam. Although the presence of this resistant sandstone would not affect subsidence from the mining of the Carbonera coal seam which overlies it, it would significantly reduce the total subsidence in the area. Observations indicating that subsidence characerisitics of a coal field tend to be uniform across the entire field (Edell, Bureau of Mines, Subsidence Control Division, oral communication, 1978) indicate that the subsidence predictions of the *Subsidence Engineer's Handbook* are conservative, 'worst case' predictions. (See Water Resources and Soils for further discussion.)

In addition, subsidence induced by mining could increase air circulation at depth through fracturing, allowing spontaneous combustion of the coal beds.

Burning of coal beds is thought to have occurred naturally under as much as 2,000 feet of overburden in the Terror Creek area of nearby Delta County, Colorado (Louis Gaspar, mining engineer, Coors Beer Company, 1977, oral communication). In addition to causing a loss of the coal resource, burning of the coal bed reduces the volume of coal and therefore may induce more subsidence above the seam.

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above impacts, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to the present lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the BLM-USGS memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

Coal

The mining and consumption of an estimated 61.6 million tons of coal under the Cottonwood Creek proposal, over an estimated mine life of 25 to 100 years, would deplete a nonrenewable energy source. The coal to be produced is expected to be exported from the area to utility plants for the production of electrical energy.

The underground mining of the coal seams by the proposed mining method would result in the recovery of approximately 50 percent of the coal. The longwall mining method is the most efficient method to recover the leased coal.

The Cottonwood No. 1 Mine should be developed and mined before development of the Cottonwood No. 2 Mine is started, except for that portion from the Roadside Mine to the rock slope tunnels. If the Cameo seam, which lies 38 to 93 feet below the Carbonera, is mined first, subsidence from the fully retreating longwall method may cause some mining problems in the Carbonera. Normally, the Carbonera seam should be mined before mining is started in the Cameo seam. The two seams could be mined simultaneously with mining in the Carbonera being in advance of mining in the Cameo. (See 30(CFR): 211.32)

Oil and Gas

If oil and gas are discovered under the leased land, a settlement between well owners and owners of the leased coal would have to be reached as to which nonrenewable energy resource would be exploited first.

Water Resources

Surface Water

The possibility of subsidence within the mining area after abandonment could severely impact the water supply to the municipality of Palisade, Colorado. If subsidence should occur the old, cast-iron water supply lines which run through the area would be severed, interrupting the municipal water supply. Subsidence is not expected but the possibility always exists.

Increases in populations for both Mesa and Garfield counties have been projected in the socioeconomic section. These population increases would cause an increased consumption of on municipal water supplies. Increases of 200 people by 1980, 1,630 people by 1985, and 1,830 people by 1990 have been projected for Mesa County. Palisade would receive most of this pressure. Water consumption increases for Mesa County may be expected to be 78 acre-feet per year for 1980, 639 acre-feet per year for 1985, and 718 acre-feet per year for 1990. Additional population increases of 60 people by 1980, 480 people by 1985, and 550 people by 1990 have been projected for Grand Valley in Garfield County. Increased municipal water consumption for Garfield County would be 24 acre-feet per year by 1980, 188 acre-feet per year by 1985, and 216 acre-feet per year by 1990.

Growth in either Grand Valley or Palisade would be limited due to their small size and limited water and sewage treatment facilities. This would force many people to live outside these municipalities within the counties. Thus, some of this water demand would be fulfilled from ground water through domestic wells. Exactly what proportion of the water supply would come from ground water cannot be estimated.

Ground Water

Cottonwood Creek Mine hopes to obtain 52 acre-feet per year of ground water from the mine to support the entire mining operation. However, no water rights for this water have been given to Mid-Continent Coal and Coke Company by the state of Colorado. Under Colorado state law, any beneficial use of ground water (dust control, washing coal, etc.) requires a well permit or a water right. The interruption of the natural ground water flow is not considered to be a significant impact in the area of the mine.

Water Quality

A decrease in suspended sediments in the Colorado River can be expected due to the establishment of the sediment retention ponds below the mining facilities area. However, in comparison with the annual sediment load of the Colorado River, the decrease would be very insignificant.

Flood Hazard

There is no danger to life or property from flash flooding. The facilities are located at the head of a small, dry unnamed drainage.

Soils

Soil impacts would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban area expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 12 feet (see Topography). Soil impacts would be minimal where no breaks occurred in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

The construction and operation of surface facilities would affect 0 acres by 1980 and 61 acres by 1985 with no further change through 1990. Erosion rates would increase in response to surface disturbance. An estimated 2- to 3-fold increase could occur in the already high natural erosion rate. Within the design limitations of the proposed action, most of this erosion would be contained on-site by drainage systems and other sediment control measures. However, these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology section). During the mine-life of at least 25 years there is over a 93 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration in soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable at present, would further complicate inherent revegetation problems of low natural moisture, poor topsoil, and often steep terrain. These problems would prolong the efforts necessary to achieve successful reclamation (see Vegetation).

Off-site disturbances due to mine-related population increases would amount to 22 acres by 1980, 180 acres by 1985, and 203 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come from croplands in Mesa County. To this extent, crop production capacity would be permanently lost. Soil erosion could initially increase from two to three times the natural rate, then gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

The bulk of the surface disturbance resulting from the mine portals and associated surface facilities would be in the arid saltbush hills immediately west of Palisade. Approximately 61 acres of rangeland dominated by shadscale, galleta grass, snakeweed, and prickly pear cactus would be disturbed by 1985 due to the development of the surface facilities, with no additional disturbance through 1990. The impacts of the disturbance would be to reduce the visual aesthetics of the area, increase soil erosion, and reduce the numbers of wildlife and livestock in the area (discussed in the appropriate sections).

Mid-Continent would be required to revegetate the 61 acres of disturbance at the Cottonwood Creek mine site upon abandonment of the mine. Specific revegetation measures that would be required by the federal coal mining regulations are stated in 30(CFR): 717.20 and 30(CFR): 211.40, 211.41, and 211.62, in the *Federal Register* (Vol. 42, No. 239, and Vol. 41, No. 96). These regulations cover the operator's (Mid-Continent's) responsibility and length of liability for revegetation. They state that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vegetation, shall be established on regraded and other affected lands' (30(CFR): 211.40(a)(13)(i)).

Problems may be encountered in attempting to revegetate the disturbed areas (such as steep south-facing slopes, low annual precipitation, high soil salinity, weed infestation) which may prolong the period of time required for successful revegetation. In such cases a five year extension of Mid-Continent's responsibility for revegetation efforts may be necessary, beyond the 5 year period initially established by the Government authorizing officer responsible for monitoring revegetation at the Cot-

tonwood Creek mine site, discussed in 30(CFR): 211.40(a)(13)(ii).

Urban expansion caused by population increase related to coal mining would result in the disturbance of an estimated 22 acres of vegetation by 1980, 180 acres by 1985, and 203 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers. This is discussed further under soils.

Increased numbers of people in the area would result in additional disturbance of native vegetation, particualrly by off-road-vehicle use (see Recreation). This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos Shale hills and in alpine areas above timberline.

Wildlife

Development of surface facilities and waste disposal sites would disturb a total of 61 acres of habitat by 1985, primarily the saltbush type, and this would be the extent of the disturbance through 1990. Something less than 61 acres would be disturbed at any given time because most of the disturbance would result from waste disposal, which would be done in steps. Small mammals and reptiles on the 61 acres would be killed during development and operation of the mine. In addition the surface facilities would be developed on crucial mule deer winter range, which would therefore support fewer deer through the five-month winter season (table MB3-1). Deer use would decrease by 21 deer per year and elk use by 2 elk per year, from 1985 to 1990. Increased human and mechanical activity would also reduce mule deer and elk use by an average of 50 percent on an adjacent 300 acres (assuming that impacts would be progressively less, the farther the habitat is from the disturbance). Other species which would be less likely to use the area include coyotes, bobcats, golden eagles, and prairie falcons. The overall impact is summarized in table MB3-1.

It is difficult to predict to what extent subsidence would affect wildlife because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Secondarily, individual animals could be frightened by humans in the area (mine workers, sightseers, etc.) and driven into the subsidence area where they could be injured or killed by the sharp changes in topography. To some extent, wildlife would gradually develop trails through the areas, which would lessen the danger for wildlife.

In Cottonwood Creek the 12 to 15 feet of subsidence (worst case) could substantially impact the deer and elk wintering areas in Cottonwood and Rapid Creeks and could cause the loss of this area to the wintering animals until the ground has stopped settling. However, even then, because of the 12 to 15 feet of topography changes, this area would not support the number of animals that it does now.

Increased road kills of small rodents and birds, and possibly mule deer in the winter, could result from mine traffic and coal trucks on the site. Off the lease area, vehicle traffic for the most part would be on I-70 or through orchard and residential lands. Because existing traffic is high, little impact is expected as a result of increases from coal mining.

New power lines could be a physical hazard to birds in flight. Poles and substations, if not properly designed, would be electrocution hazards to the larger raptors.

The cliffs lying above the Blue Flame and Go-Boy tracts are suitable for use by cliff nesting species, such as golden eagle and prairie falcon, which are known to utilize cliffs in the vicinity. Approximately 1 mile of cliff face would no longer be usable habitat due to the mine activity planned on the bench at the foot of these cliffs.

Species associated with the riparian vegetation type could decrease if the present loading facilities are expanded. The habitat adjoining the present facilities is becoming saturated with species that were occupying areas that have been stripped of their vegetation. If more area is cleared, then more animals would be forced into smaller areas; density-dependent limiting factors could then begin to cause some animal deaths and stress to all species. The losses are very difficult to quantify, primarily because of the lack of information on just how large a population triggers these density-dependent factors. It is well documented, however, that as density increases, reproduction decreases, causing a decline in the total population over time. The decrease in prey species could affect the predatory species within this habitat type, especially the bald eagle and the peregrine falcon, which might abandon this area as a hunting range.

Secondary impacts from the proposed action would include increased human population, resulting in expansion of urban areas onto agricultural lands and some crucial winter range; increased vehicular traffic, resulting in an increase in vehicle/animal collisions; and increased recreational use of the area, causing an additional stress on the animals and increasing legal and illegal harvest of animals. This illegal kill could increase 10 times or 1000 percent over current estimates (Al Whitaker 1978, personal communication).

Endangered or Threatened Species

In the vicinity of the Colorado River, increased truck traffic and unit train loading facilities could

TABLE MB3- 1

IMPACTS ON WILDLIFE

Year	Total Disturbed Acres	Number of Animals that These Acres Could Support					Additional Acres Disturbed	Additional Animals that Could be Supported		
		DDA	D	EDA	E	WH		D 50%	E 50%	WH 50%
1977	0	56	0	1.6	0	-	-	-	-	-
1980	0	56	0	1.6	0	-	-	-	-	-
1985	61	56	21	1.6	2	-	300	51	4	-
1990	61	56	21	1.6	2	-	300	51	4	-

Note: DDA = deer days per acre; EDA = elk days per acre; D = deer; E = elk; WH = wild horses.

disrupt hunting activities for two important raptors, the bald eagle and the peregrine falcon. The site for the loading facilities, on private land, has already been cleared of its vegetative cover, eliminating most of its value to raptors. Further clearance or disturbance in the riaparian type adjacent to the Colorado River could further diminish the amount and quality of hunting areas for these two species, since the prey for both species is generally found in riparian or aquatic habitats.

Aquatic Biology

Specific details of planned water and drainage systems and refuse disposal areas are not given in the mining plan. No discharge of water is presently planned from the mining operation. However, according to the mining plan, if surplus water is produced, it would be discharged into surface drainages. If these discharges are of poor physical or chemical quality, they must be made to comply with 30(CFR): 717.17 water quality regulations, which may require extensive treatment of the water before discharge. If this section of the river receives designation as critical habitat for the Colorado squawfish by the Secretary of the Interior then any action taken on a federal coal lease which would diminish the value of the Colorado River as aquatic habitat would be in direct conflict with Section 7 of the Endangered Species Act of 1973. In no case would any change in the water chemistry of the Colorado River be consistent with federal law.

Sediment retention ponds and a refuse disposal pile pose a potential threat to aquatic life in the Colorado River. Specific designs of these facilities are not given in the mining plan. Proper location and construction of these facilities is essential to assure that failure or washout will not occur during a flood. Breaching of a settling pond would release materals into surface drainages which could cause the extinction of several threatened and endangered fish species in the adjacent Colorado River.

Cultural Resources

Archeological Resources

Archeological sites within the vicinity of Cottonwood Creek Mine and the presence of Cottonwood and Rapid Creeks and pinyon-juniper breaks, suggest the potential for archeological sites (Connor 1976). Surface disturbance from construction and mine activities could destroy, remove, or alter any archeological sites existing within the 61 acres proposed for surface disturbing actions. In addition, subsidence, as it could affect 5,040 acres, could create surface disturbances which could displace or damage existing archeological values. With controlled access into the lease area, vandalism should remain a minimal impact within the site-specific area, although the presence of 400 mine-associated employees in the lease area (by 1990) would mean increased exposure of archeological sites to public passage.

Prior to approval of the proposed action, a concurrence of approval could be developed by the BLM with Mid-Continent to establish Mid-Continent's responsibility in the protection of cultural resources. Provisions could be made to conduct class III surveys on private land designated for surface disturbance as well as to provide for work stoppage and compliance with Section 106 (National Historic Pres. Act, amended 1976.) should archeological values be discovered after the proposed action has been initiated. In addition, should areas of surface subsidence be identified, a class III inventory of these impact areas should be undertaken in order to minimize potential damage to archeological values.

Historical Resources

Because the extent of historic sites in the mine area is not fully known, the following impacts may occur. Surface disturbing activities, such as mining or construction of facilities and roads, could disturb buried sites or destroy sites that might be considered worthless by the project's engineers. Because of the instrusion of buildings, roads, fences, etc., some sites might lose the aesthetic integrity which is important to the overall quality of the site (as outlined in 36(CFR): 800.9). Sites remaining near or at the project might be vandalized due to increased access or human use; damage could include 'stripping' of wood, removal of artifacts, etc.

Transportation

Highways

Traffic on I-70 would increase as a result of mine personnel going to and from work. The work force of 400 people could increase daily traffic by as much as 530 vehicles per day. This is about a 10 percent increase over 1976 levels. There would be increased accidents as a result of greater traffic.

Coal would be trucked on a private road from the coal preparation plant near the mine to the rail loading facilities near the Cameo power plant. There would be no coal truck traffic on I-70.

Railroads

Coal from the Cottonwood Creek mines would be transported from the loading facilities near the Cameo power plant to the consumer in unit trains using the Denver and Rio Grande Western Railroad facilities. At full production of 1 million tons per year, one or two trains per week would be required to move the coal. The mining plan mentions no specific market but presumes it will be a

utility company outside of Colorado. These two trains per week would add to the congestion in eastern slope cities where coal from other producing areas also passes.

Airports

Passenger traffic at Walker Field would increase as a result of the Cottonwood mine development. Facilities at the airport are adequate to handle this increase.

Livestock

Approximately 6 animal unit months (AUMs) of forage would be lost annually during the life of the mine, beginning in 1985 and continuing through 1990, due to the disturbance of 61 acres of the saltbush type by that year (see vegetation). This disturbance would result from the construction of the mine portals and associated surface facilities, including the preparation plant, offices, warehouse, bathhouse, parking lot, coal disposal and storage areas, settling ponds, electrical substation, and haulage and power line rights-of-way. The livestock qualifications (maximum livestock use permitted) on the public land disturbed would have to be reduced due to this loss of livestock forage. However, the reduction in AUMs is only 2.16 percent of the total before the mine, (qualifications = 278 AUMs) and would not result in severe hardship to the livestock operator grazing the Cottonwood Creek Lloyd allotment.

Approximately 12 AUMs would be restored to the disturbed areas upon successful revegetation following abandonment of the mine. This prediction is based on the assumption that the species mixture used in revegetation would consist primarily of grasses, and that palatable grass species would be a much higher percentage of the reestablished vegetation (to as much as 70 to 90 percent) than they were of the original vegetation (further discussed in the regional volume).

None of the range improvements proposed in the new allotment management plan for the Lloyd and Cottonwood Creek allotments would be affected by the proposed surface facilities.

It is very likely that some of the acreage disturbance resulting from urban expansion due to increased population (23 in 1980, 190 in 1985, and 229 in 1990) would be on irrigated and nonirrigated hayland and pasture. This would adversely affect the livestock industry because these lands are used as livestock wintering areas, and the hay harvested from them in the summer is used to feed the livestock during winter.

Recreation

The influx of additional population due to the Cottonwood Creek site and the subsequently increased demand for recreational opportunities could have an impact on existing recreation resources and facilities, particularly community facilities in the Grand Junction-Palisade area. Since Grand Junction's recreational facilities are now fully utilized (Grand Junction Recreation Department 1977), increased use would result in overuse which would lead to their deterioration and lower their capacity to provide enjoyable recreation. The community facilities needed to meet the increased demand and prevent overuse are projected in table MB3-2, which shows a need for 0.9 acre of active/improved park land by 1980, 7.0 acres by 1985, and 7.8 acres by 1990. Capital investments to provide the facilities are also projected in table MB3-2.

The increased demand for dispersed recreation opportunities (e.g., hunting, hiking, ORV use) should not adversely affect the recreation resource; however, concentrated use, such as an ORV rally, could lead to vegetative deterioration and reduce the recreational experience on that site. Increased use of recreational facilities (such as Island Acres Recreation Area) would lead to increased maintenance costs for the managing agencies. The extent of the increased usage and costs are not known.

The increased use of recreational facilities could be offset by providing additional facilities. The Heritage Conservation Recreation Service through the Land and Water Conservation Fund Act (PL 88-578), could provide monies for this purpose if matching funds are provided by the local agency. The Mineral Leasing Funds (Co. S.B. No. 35, Section 2, 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreation facilities under the Recreation and Public Purposes Act, 43(CFR): 2740, which allows nonprofit associations to acquire lands for recreation purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior; therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The lands of the Cottonwood Creek lease site are not now proposed for any wilderness study and, due to the presence of existing roads, are not expected to be studied.

Visual Resources

Construction of offices, shops, etc., would be a change in land use, resulting in some disturbance of landforms and vegetation. (See appendix F for contrast ratings.) The site would be difficult to see because it is located above I-70 and is masked by a small hill. Thus, it would be visible only to eastbound traffic and only for approximately 22 sec-

TABLE MB3-2

COTTONWOOD CREEK: ADDITIONAL COMMUNITY RECREATION FACILITIES DEMAND

	1980	1985	1990
Population growth	260	2,110	2,380
Active/improved parks a/ (3.3 acres per 1,000 residents)	0.9 acres	7.0 acres	7.8 acres
Capital investment ($66,666 per 1,000 residents)	$17,333	$140,665	$158,665

Source: Bickert, Browne, Coddington, and Associates, Inc., Boomtown Financing Study, Vol. II, (July 1976).

a/ Ballfields, tennis courts, playgrounds, etc.

onds. The present visual resource management (VRM) Class IV rating for the area stipulates that changes may dominate the original landscape but that they should reflect what could be a natural occurrence. The roads, wash plant, etc., would dominate the site but could never be interpreted as natural. Given this criterion, the VRM Class IV would have to be reevaluated and probably changed to a Class V to incorporate rehabilitation objectives for the post-mining landscape.

The refuse disposal site is situated at the base of a steep hill. The severity of the visual impact of 300,000 tons of refuse annually would depend on (1) the color of the material and (2) the success of the revegetation program. The refuse would alter the landform shape and the existing vegetative pattern, and it would eventually add an approximately 58-acre surface that would look unnatural due to the required terracing. Terrain masking would obscure the lower portions of this refuse area for I-70 travelers.

The coal haulage trucks, employee traffic, power lines, etc., resulting from the mine would further change the general landscape character of the southern end of DeBeque Canyon; air pollution would reduce visability by an average of 6 miles for the extreme eastern end of the Grand Valley. The visual attractiveness of the canyon has been modified by the existing Roadside Mine operation, Cameo power plant area, power lines, etc. If this industrial land use is expanded because of the Mid-Continent proposal, the visual resource of the canyon would be further degraded. The current VRM Class II rating for most of DeBeque Canyon would be further reduced by the continued development in the canyon.

Socioeconomic Conditions

Demography

In calculating the population growth associated with the Cottonwood Creek mine, the same assumptions were used as were used with the Coal Canyon mine, that is, that 80 percent of the employees would reside in Mesa County and that the remaining 20 percent would reside in Garfield County. The Cottonwood Creek operation from the mid-level population projection, there would be a difference in population of 200 persons by 1980, 1,630 persons by 1985, and 1,830 persons by 1990 in Mesa County. In Garfield County the increase in population due to the Cottonwood Creek mine would be about 60 people by 1980, 480 people by 1985, and 550 people by 1990.

The community of Palisade, in Mesa County, is the closest town to this mine site, as well as to the Coal Canyon and General Exploration Company's Cameo No. 1 mine sites. As a result, Palisade would experience a great deal of growth pressure; however, actual growth in Palisade would be limited because of its small size and water and sewer treatment design capacities. As chapter 2 points out, both the water and sewer treatment facilities in Palisade are being upgraded to accommodate about an additional 1,500 people.

Most of the in-migrating population associated with the Coal Canyon Mine which does not settle in Palisade is expected to settle in the Grand Junction area. The small communities of DeBeque and Collbran would also receive some population influx as a result of Coal Canyon.

County to the Coal Canyon site. Since these two communities are expected to experience strong growth pressures from the numerous oil shale development operations in the same area, as well as the Coal Canyon and Cameo No. 1 mines, available housing should be at a premium. This may result in a scattering of population growth throughout Garfield County from the Coal Canyon Mine.

Community Attitudes and Lifestyles

The combined development of the Coal Canyon, Cottonwood Creek, and Cameo No. 1 mines may have a pronounced effect upon the small community of Palisade. Palisade has remained a stable, aricultural community, with a relatively high concentration of older persons, for some time. A rapid influx of new population would certainly disrupt the present character and social structure of the community. It would also place a burden on the elderly residents as the cost of living rises due to the demand for increased local government services. General changes expected in attitude and lifestyle due to increased coal mining in the area are discussed in the regional volume.

Community Facilities and Services

The projected minimum community facility requirements for Mesa and Garfield counties associated with the Cottonwood Creek operation are listed in table MB3-3. These figures were derived in a similar manner to those contained in the regional volume in table R4-19.

Table MB3-3 does not reflect the major capital expenditures which are now being made in many communities in both Mesa and Garfield counties. These cost figures represent needed capital requirements over and above any facilities which exist or which are under development.

Increases in the local property and sales tax revenues attributed to the Cottonwood Creek development are listed in table MB3-4. These revenues represent the total property and sales tax revenues expected to flow to all local government entities. Since the estimated increases in community facility expenditures would be borne by county, municipal, or special district units of local government, it is necessary to subtract out the school district share

of the revenues in order to make a comparison. If this is done, it decreases the locally derived revenues available for county, municipal, and special district purposes in Mesa County to an estimated $59,120 in 1980, $408,040 in 1985 and $433,090 in 1990. Comparing these revenues with the yearly operating expenses and amortized (at 6 percent interest over twenty years) capital expenses of $282,200 per year shows that Mesa County would experience a revenue deficit from the Cottonwood Creek Mine in the first few years of operation, but that would change to a revenue surplus by 1985.

Locally derived revenues available for county, municipal and special district purposes in Garfield County are estimated to be $6,680 in 1980, $56,040 in 1985 and $66,490 in 1990. Comparing these revenues with the yearly operating expenses and amortized capital expenses of $70,500 per year shows that Garfield County would also experience a revenue deficit throughout the years of operation.

The Cottonwood Creek mine would pay large amounts to various levels of government in the form of royalties and taxes. Chapter 4 of the regional volume explains in detail what the programs are and how they work.

Royalties would be paid to the federal government when Mid-Continent mines federal coal. In 1985, this would amount to $640,000, of which the state of Colorado would receive $320,000. Mesa County would receive half of this amount, or $160,000. However, receipts from all royalty payments to any county are limited by Colorado law to $200,000. Mesa County likely would reach this limit, considering the other mineral developments in the county.

Although the state severance tax was originated partially to help impacted counties deal with growth, this law would provide very little relief to Mesa County. Presently, 45 percent of the severance tax paid by a coal mine goes into a local government severance tax fund and is used to halp impacted counties. After June 30, 1981, however, all severance taxes are assigned into the state severance tax trust fund. Proceeds from the investment of this fund would go to the state general fund. Unless future legislative action amends the law, severance tax funds will provide little relief to Mesa County.

As explained in chapter 3 of the regional volume, investment in this mine is expectd to be $36,000,000. Property taxes on this amount would be $710,860 per year in 1985 and 1990. Table MB3-5 shows how the property tax revenues would be distributed among the various recipients.

Housing

The projected demand for new housing in Mesa and Garfield counties as a result of population growth attributed to the Cottonwood Creek operation is summarized in table MB3-6. The assumptions regarding housing mix and family size that were also used in the regional volume were used in these calculations.

The housing requirements associated with the Cottonwood Creek mine represent about 5 percent of the total projected new housing requirements in Mesa County by 1990 and about 2 percent of the projected new housing requirements in Garfield County by 1990. This housing and its related roadway requirements would use approximately 7 acres of land in Mesa County in 1980, 139 acres in 1985, and 155 acres in 1990, and approximately 5 acres of land in Garfield County in 1980, 41 acres in 1985, and 47 acres in 1990.

Schools

The expected increase in school-aged population due to the development of the Cottonwood Creek mine is shown in table MB3-7, along with the increase in school district capital requirements and operating costs anticipated from that population increase.

Most of the increase in school-aged population within Mesa County due to the Cottonwood Creek mine development would occur within School District 51 (see map). Since the mine itself is also located within the jurisdictional boundaries of School District 51, that district would receive an additional $10.8 million in assessed valuation from the facility itself by 1990. That increase in assessed valuation would allow the district to increase its bonded indebtedness by $2.2 million, which is in excess of the projected capital facility requirements.

School District 49(JT) in DeBeque would be required to provide for some of the increase in Mesa County school population associated with Cottonwood Creek. Even though District 49(JT) would not benefit from any increase in property tax base from the Cottonwood Creek Mine, the tax base increase it is expected to receive from the Sheridan mine would be more than sufficient to meets its capital requirements. The increases in school operating costs projected for Mesa County, as a result of the Cottonwood Creek development, would be met by increased school district revenues without an increase in tax rates.

In Garfield County, increases in school-aged population from Cottonwood Creek would occur in the Grand Valley District 16 and the Garfield District RE-2. The total expected increase in property tax base in Garfield County by 1990 from the Cottonwood Creek Mine is $2,148,000. That increase would allow the Garfield County school districts to raise their bonded debt by $430,000 or about $231,000 less than the estimated requirement for school capital facilities.

Health Care

Population growth associated with the Cottonwood Creek Mine is expected to increase the demand for health care facilities in the Grand Junction area and the Rifle area. Due to their proximity to the Grand Junction area, neither the Cottonwood Creek Mine nor its two neighbors, the Coal Canyon and Cameo No. 1 mines, are likely to have significant adverse effects on the area's health care failities individually. However, since population growth as a result of these three operations would affect the same area, the cumulative effect on health service delivery is important. There would most likely be a need for expanded health care services in the town of Palisade, especially emergency services, to all three operations. Table MB3-8 is an estimate of the capital facilities needed in Mesa and Garfield counties to meet the projected increase in demand for health care services from all three mines in the Cameo area.

Most of the existing health care facilities in the area are supported by fees collected for services performed instead of through local tax revenues.

Employment

Development of the Cottonwood Creek mine would increase employment in Mesa and Garfield counties. In 1980, employment at the mine is projected to reach 225 persons, which would increase total employment by 101 in Mesa County and by 93 in Garfield County. By 1985, employment at the mine would have stabilized at 400 persons, increasing total employment by 808 in Mesa County and by 358 in Garfield County. In 1990, total employment would increase by 3,021 in Mesa County and by 731 in Garfield County.

Income

An operation the size of the Cottonwood Creek Mine, employing 400 people at full production, would significantly increase income in Mesa County. In 1975, median family income in Mesa County was $11,130, whereas average income among mine personnel is expected to be $16,600 per year. Table MB3-9 shows employment, payroll, and regional income generated by the Cottonwood Creek Mine.

TABLE MB3-3

COTTONWOOD CREEK: ADDITIONAL REQUIREMENTS FOR COMMUNITY FACILITIES

Facility	Mesa County					Garfield County				
	Physical Plant Requirements	Capital Costs 1990	Operating Costs/Year			Physical Plant Requirements	Capital Costs 1990	Operating Costs/Year		
			1980	1985	1990			1980	1985	1990
Water treatment	0.64 mgd	$ 560,200	$ 4,400	$ 35,800	$ 40,200	0.19 mgd	$168,500	$1,300	$10,500	$12,100
Sewage treatment	0.18 mgd	$ 604,000	$ 3,200	$ 26,200	$ 29,500	0.05 mgd	$181,500	$1,000	$ 7,700	$ 8,800
Police protection	1 vehicle & 730 sq.ft.	$ 56,900	0	$ 60,000	$ 80,000	220 sq.ft.	$ 14,700	0	$20,000	$20,000
Fire protection	1 vehicle & 1,800 sq.ft.	$ 147,000	0	$ 36,000	$ 36,000	550 sq.ft.	$ 22,000		Volunteer	
Streets and roads	55 acres	$1,769,000	$ 3,500	$ 41,700	$ 53,500	17 acres	$394,000	$3,500	$14,000	$16,000
General government	450 sq.ft.	$ 29,000	0	$ 54,000	$ 54,000	140 sq.ft.	$ 9,000	0	$18,000	$18,000
Libraries	5,490 books & 1,000 sq.ft.	$ 74,000	0	0	0	1,650 books & 300 sq.ft.	$ 18,900	0	0	0
Total	-	$3,240,100	$11,100	$253,700	$293,200	-	$808,600	$5,800	$70,000	$74,900

Note: mgd = million gallons per day; sq.ft. = square feet of space.

TABLE MB3-4

COTTONWOOD CREEK: INCREASED REVENUES TO GARFIELD AND MESA COUNTIES

	1980	1985	1990
Garfield County:			
Property Tax			
Homes	$14,220	$129,590	$145,780
Businesses	5,130	41,080	47,070
Sales Tax	9,920	79,390	90,970
Service Fees	2,710	21,700	24,410
Total	$31,980	$271,760	$308,230
Mesa County:			
Property Tax			
Homes	$ 92,520	$ 423,620	$ 475,600
Businesses	11,550	89,630	100,630
Mine	0	776,910	876,000
Sales Tax	26,170	203,100	228,020
Service Fees	4,960	38,440	43,800
Total	$135,200	$1,531,700	$1,724,050

TABLE MB3-5

COTTONWOOD CREEK: DISTRIBUTION OF PROPERTY TAX REVENUES

Year	County	Municipalities	Special Districts	Schools
Garfield County:				
1980	$ 5,070	$ 1,270	$ 340	$ 12,690
1985	42,550	10,640	2,850	106,520
1990	50,480	12,630	3,380	126,360
Mesa County:				
1980	$ 31,280	$23,170	$ 4,670	$ 89,440
1985	285,410	80,040	42,590	816,080
1990	298,670	89,860	44,560	854,000

TABLE MB3-6

COTTONWOOD CREEK: NEW HOUSING REQUIREMENTS

Housing Units	Mesa County 1980	Mesa County 1985	Mesa County 1990	Garfield County 1980	Garfield County 1985	Garfield County 1990
Single-family units	43	353	396	13	104	119
Mobile homes	17	136	153	5	40	46
Multi-family units	7	54	61	2	16	18
Total	67	543	610	20	160	183

TABLE MB3-7

COTTONWOOD CREEK: SCHOOL DISTRICT FACILITY REQUIREMENTS

County and Year	Increase in School-Aged Population	Facility Requirements (square feet)	Facility Costs (dollars)	Operating and Maintenance Costs (dollars/year)
Mesa:				
1980	55	7,700	346,500	67,700
1985	370	51,800	2,330,000	45,500
1990	375	52,500	2,363,000	461,000
Garfield:				
1980	15	2,100	94,500	18,450
1985	105	14,700	661,000	129,000
1990	105	14,700	661,000	129,000

TABLE MB3-8

COAL CANYON, COTTONWOOD CREEK, CAMEO NO. 1: PROJECTED HEALTH CARE FACILITY REQUIREMENTS

County and Year	Facility Requirements	Facility Costs (dollars)
Mesa:		
1980	1 hospital bed	55,000
1985	9 hospital beds and 1 emergency vehicle	510,000
1990	10 hospital beds and 1 emergency vehicle	565,000
Garfield:		
1980	0	0
1985	3 hospital beds	165,000
1990	3 hospital beds	165,000

TABLE MB3-9

COTTONWOOD CREEK: EMPLOYMENT, PAYROLL, AND REGIONAL INCOME

Year	Employment	Payroll	Regional Income
1980	50	$ 830,000	$ 1,261,600
1985	400	6,640,000	10,092,800
1990	400	6,640,000	10,092,800

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce or eliminate specific adverse impacts of Mid-Continent Coal and Coke Company's proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the Cottonwood Creek mining and reclamation plan is approved, they would be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

Cottonwood Mitigating Measure 1

Coal will be hauled only during daylight hours.

Cottonwood Mitigating Measure 2

Power lines and associated poles will be raptor-proofed in accordance with Bureau of Land Management (BLM) standards as outlined in BLM Manual 2850 and Instrucional Memorandum No. CO78-30 (February 10, 1978).

Mid-Continent will be required to reach agreements with the Ute Water Conservancy concerning damage to the facilities and the water supply caused by the mining operation.

Cottonwood Mitigating Measure 4

A surfactant will be added to the water spray on the conveyors and transfer points. This mitigating measure will be required by the Colorado Air Pollution Control Division as a condition of the mine's operating permit.

Cottonwood Mitigating Measure 5

Paving of on-site access roads, tentatively proposed by the mining company, will be required as a condition for BLM concurrence with the mining plan.

Analysis of Effectiveness

Cottonwood Mitigating Measure 1

Reducing the number of vehicles on the road during the dusk to dawn hours would reduce the road kills by an unquantifiable number.

Cottonwood Mitigating Measure 2

Raptor-proofing power poles would prevent electrocution of eagles and other large birds.

Cottonwood Mitigating Measure 3

The effectiveness of this measure would depend upon the particular agreement reached.

Cottonwood Mitigating Measure 4

In the mining plan, Mid-Continent proposes that the conveyors and transfer points be controlled by water spray, with an estimated 50 percent control efficiency. By adding a surfactant to the spray system for longer-duration dust suppression, an estimated 85 percent reduction can be achieved. The use of a surfactant would reduce projected 1985 emissions from these two sources by 23 tons per year and 1990 emissions by 57 tons per year.

Cottonwood Mitigating Measure 5

The mining plan states that on-site roads will be paved, oiled, or sprayed with water. In determining the impact of the mine initially, it was assumed that both haul roads and access roads would be oiled except where existing roads are already paved. Paving of haul roads would not result in futher emission reductions, but paving of on-site employee access roads would increase the control efficiency from 95 to 99 percent. This would reduce projected emissions by 24 tons per year in 1985 and 48 tons per year in 1990.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by the construction and operation of Mid-Continent Coal and Coke Company's Cottonwood Creek proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

The application of the mitigating measures discussed in the previous chapter will significantly reduce annual particulate emissions from the Cottonwood Creek mine. In calculating the emission reductions, it was assumed that paving of access roads on the mine property would produce a 93 percent emission reduction over that gained by the proposed oiling. Table MB5-A presents the total annual expected emissions for each study year as a result of the mitigating measures. This reduction in annual emission will result in a lessening of air quality impact. Because of the modeling procedure used, short-term maximum concentrations should decrease in direct proportion to emission reductions.

Annual average concentrations for the study area were predicted with the model discussed in chapter 3, substituting the reduced emissions from the mitigating measures. Due to the location of the section of access road subject to the mitigating measures, local impact reductions of approximately 70 percent would occur near the mine facilities while total reductions over the entire area would be almost imperceptible. Maximum 24-hour concentrations would decrease to 88 micrograms per cubic meter ($\mu g/m^3$), while maximum annual concentration would be reduced to 20.4 $\mu g/m^3$.

TABLE MB5-A

TOTAL ANNUAL PARTICULATE EMISSIONS

(ton/yr)

Study year	Without mitigating measures	With mitigating measures	Percent reduction
1985	188	164	13
1990	418	370	12

Geologic and Geographic Setting

Topography

Adverse environmental effects which cannot be avoided under the proposed mining plan would include minor alterations to the land surface from installation, use, and removal of surface facilities, and the subsequent reclamation of the area. Subsidence of a maximum of 12 feet of surface could occur over the coal bed under 'worst case' conditions. This continued subsidence would result in fracturing and slumping of the surface, thereby setting the stage for erosion and hazards to livestock, wildlife, people, and surface facilities.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

Mineral Resources

The mining of the coal under the Cottonwood Creek proposal would have an unavoidable effect on the coal seams and coal reserves. The mining would deplete a nonrenewable mineral commodity. Based on company plans to produce an estimated 1 million tons of coal annually from 1986 on, the proposed Cottonwood Creek project would last 25 to 100 years. Production of the estimated 61.6 million tons of recoverable reserves would represent approximately 24 percent of the total Grand Mesa coal field reserves in Mesa County. Because of the nature of underground caving and resultant high contamination after mining is complete, future recovery of the abandoned approximately 50 percent of the coal reserves under the lease area is not considered feasible with present technology, and therefore these reserves must be considered as lost.

Water Resources

Water consumption increases for Mesa County may be expected to be 78 acre-feet per year for 1980, 639 acre-feet per year for 1985, and 718 acre-feet per year for 1990. Increased municipal water consumption for Garfield County would be 24 acre-feet per year by 1980, 188 acre-feet by 1985, and 216 acre-feet per year by 1990.

Soil

Surface disturbance on approximately 0 acres by 1980 and 61 acres by 1985 and on through 1990 at the mine site would cause an increase in erosion and a deterioration of soil structure and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would prolong the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 22 acres by 1980, 180 acres by 1985, and 203 acres by 1990 from a production function. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine site on 0 acres in 1980, and 61 acres in 1985, and on through 1990. If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than these firgures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action.

Wildlife

Construction of surface facilities would destroy wildlife habitat on 61 acres for the life of the mine beginning in 1985. This area could support 21 deer and 2 elk annually. During construction, small immobile animals, dens, and reptiles would be destroyed. On the lands adjacent to mining facilities (300 acres), deer use would be reduced by an average of 50 percent, and a portion of crucial winter range would be destroyed if facilities are constructed in the proposed location. Approximately 1 mile of cliff would be lost as potential nesting habitat for the golden eagle and the prairie falcon.

Archeological Resources

Undiscovered sites could be damaged during surface disturbing activities and by subsidence. In addition, information about sites could be lost as a result of vandalism and illegal collecting or as a result of salvage excavation procedures where any information not recorded would be permanently lost.

Transportation

The most serious problems would be increased accidents that result from more traffic on I-70. In addition, increased rail traffic would increase congestion. Passenger traffic at Walker Field would also increase.

Livestock

Six animal unit months (AUMs) per year would be lost due to the disturbance of 61 acres beginning in 1985 and continuing through 1990. Increased off-road vehicle use would decrease productivity of natural vegetation by an unquantifiable amount. Agricultural lands disturbed by urban expansion would result in the loss of an unquantifiable amount of livestock forage and livestock wintering areas.

Recreation

If the community recreation facilities needed to prevent deterioration of existing facilities are not provided, this deterioration would be an unmitigated impact.

Visual Resources

The addition of another mine in DeBeque Canyon and the construction of associated utilities and roads would unavoidably expand and emphasize the industrial character of the landscape in the southern end of the canyon. Additional employee and service traffic would produce additional vehicle traffic and intersection delays on the local road system, which would subsequently influence the visual perception of the area.

The deposition of mine refuse would establish new slopes and terrain features on the existing topography. If revegetation and rehabilitation of the site is slow or unsuccessful, then this landform change may not eventually blend into the existing topography.

Socioeconomic Conditions

Population influx from the development of the Cottonwood Creek Mine and its neighbors, the Coal Canyon and Cameo No. 1 and No. 2 mines, would have the greatest effect upon the community of Palisade. The resulting social changes which are anticipated in Palisade, such as loss of small town atmosphere, inflation, and conflicts between new and long-time residents, would be unavoidable unless a stance is taken by the community to discourage growth. New population from the Cottonwood Creek Mine would be 260 people in 1980, 2,110 people in 1985, and 2,380 people in 1990. Increases in total employment would be 194 people in 1980, 1,166 people in 1985, and 3,752 people in 1990.

These increases are only a small portion of the total growth expected. In fact, the entire Grand Junction area's ability to absorb population growth is expected to be severely strained between 1978 and 1985, with the new population brought in by these three mines compounding the problem.

The revenue generated from Coal Canyon by local property and sales taxes in Mesa and Garfield counties would lag behind the increased expenditures needed for community facilities in the first few years of operation. By 1985, however, both counties would have a net revenue surplus from the project.

Increased school district revenues from the project would more than offset increased school costs in Mesa County. On the other hand, the school districts in Garfield County would require about $75,000 for school costs resulting from the project, in addition to what would be generated locally from increases in the tax base.

In Mesa County about 17 acres of land would be required for housing in 1980. This would rise to 139 acres in 1985, and 155 acres in 1990. In Garfield County, 5 acres would be required in 1980, 41 acres in 1985, and 47 acres in 1990.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 61.6 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment.

There would be the following alterations in the short-term, a period beginning with on-site construction and ending with end of mine life (about 2040) and post-mining reclamation:

1. An estimated 61.6 tons of coal would be exported to electric-generating companies outside Colorado.

Mining activity would increase particulate air quality concentrations by a maximum of 20 $\mu g/m^3$ in a small area near the bridge over the Colorado River at Cameo. Concentrations are predicted to increase by 10 $\mu g/m^3$ for a distance of about one mile from the surface facilities and along the haul road north toward the loadout facility. Annual average concentrations due to the mine, existing sources, and background are predicted to reach a maximum of 62 $\mu g/m^3$ in 1990, which is below primary and secondary air quality standards. Predicted maximum 24-hour concentrations in the DeBeque Canyon area would be about 150 $\mu g/m^3$ and would occur near the Cottonwood Creek site. The maximum particulate concentration for the DeBeque Canyon area would be 69 $\mu g/m^3$. This maximum concentration would occur in the vicinity of the loadout facility near the river and would be aggravated by the coal hauling activities of the Cottonwood Creek Mine. Estimated source contributions of approximately 20 to 69 $\mu g/m^3$ would be caused by Cottonwood Creek, 40 are due to background, 2 are due to existing sources, 3 would be caused by Cameo No. 1 and 2 mines, and 4 would be caused by Coal Canyon Mine. The maximum concentration of 69 $\mu g/m^3$ is below the primary standard of 75 $\mu g/m^3$, but 9 $\mu g/m^3$ is below the primary standard of 75 $\mu g/m^3$, but 9 $\mu g/m^3$ above the secondary standard of 60 $\mu g/m^3$. The area exceeding the secondary standard would be less than one square mile, centered around the combined loadout facility.

2. Throughout the life of the mine, water quality changes would be minimized by the site drainage system. Nevertheless, this system is only designed for the 10-year/24-hour event. Runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site would then cause at least short duration impairment of stream quality with resultant negative impacts on aquatic biology.

3. There would be loss of soil productivity on 61 acres through 2040 due to increased erosion, deterioration of soil structure, and reduced biological activity, and there would be loss of vegetation on those 61 acres due to loss of soil productivity.

4. Wildlife habitat on 61 acres, which could have supported 21 deer and 6 elk annually, would be completely lost.

5. Increased traffic on I-70 would increase the number of road accidents.

6. Approximately 6 animal unit months (AUMs) of livestock forage would be lost annually.

7. The addition of another mine in DeBeque Canyon and the construction of associated utilities and roads would unavoidably expand and emphasize the industrial character of the landscape in the southern end of the canyon. Additional employee and service traffic would produce additional vehicle traffic and intersection delays on the local road system, which would subsequently influence the visual perception of the area.

8. The school districts in Garfield County would require about $15,000 for school costs resulting from the project, in addition to what would be generated locally from increases in the tax base.

9. Total direct, indirect, and induced income generated by this project would be $10,092,800 by 1990.

Residual effects of mining (after post-mining reclamation) on long-term productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.

2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.

3. An estimated 61.6 million tons of coal, a nonrenewable energy resource, would be depleted.

4. There would be an increased consumption of municipal water of at least 718 acre-feet per year in Mesa County and 216 acre-feet per year in Garfield County.

5. Soil and natural vegetative productivity would be permanently lost on 203 acres due to urban expansion.

6. Surface construction, subsidence, and vandalism would disturb or destroy an unquantifiable number of nonrenewable cultural resources.

7. Archeological survey and excavation could provide gains in understanding of prehistoric use in the area.

8. Approximately 12 AUMs of livestock forage per year would be restored on the lease area upon revegetation after the mine is abandoned.

9. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present facilities would be a long-term adverse impact.

10. The deposition of mine refuse would establish new slopes and terrain features on the existing topography. If revegetation and rehabilitation of the site is slow or unsuccessful, then this landform change may not eventually blend into the existing topography.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 61.6 million tons of coal would be recovered from the Loma project mine. About 76.4 million tons would be lost due to current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 61 acres for the life of the mine, and irreversibly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 61 acres, which could have supported 21 deer and 2 elk per year, would be irretrievably lost for the life of the mine.

Approximately 6 animal unit months of livestock forage would be irretrievably lost for the life of the mine. An unquantifiable amount of livestock forage and livestock wintering areas would be irreversibly lost due to disturbance of agricultural lands by urban expansion.

Anything other than in-place preservation of archeological artifacts involves an irreversible, irretrievable commitment of the resource. Damage from surface disturbance or vandalism would result in a permanent loss of information and would remove archeological values from future research considerations.

An irretrievable commitment of capital and land (at least 203 acres) would be required to support population growth.

Particulate air quality at the proposed mine site will be subject to an increase in concentrations. Air quality will be temporarily degraded during the mine life, but the change will not be irreversible. With termination of mining activity air quality will return to the premining level of about 42 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean from the levels during mining of 47-62 $\mu g/m^3$.

Reduction in visibility will occur in proportion to the increased particulate concentrations. Average visibility is presently about 54 miles. The higher level of particulate during mining activity will decrease visibility somewhat (to 48 miles), but this loss will also be reversible. However, secondary development related to the proposed action will result in some permanent degradation of visibility in the Grand Valley area.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan is Rejection of Mid-Continent Coal and Coke's Cottonwood Creek proposed M&R plan would result in no additional environmental impact from coal mining on the federal leased lands. Since these lands are public lands surface use would be governed by Bureau of Land Management (BLM) policy and management guidelines and decisions. Mid-Continent could submit a new M&R plan, challenge the rejection, or abandon development of the lease.

Coal from the proposed Cottonwood Creek Mine is intended to supply 61.6 million tons of coal to electric-generating companies outside Colorado. Without the Cottonwood Creek mine, other coal would have to be acquired to supply these markets. Such a substitution could create a shortage for other coal markets.

The Cameo Power Plant is likely to cause slightly higher particulate concentrations than presently exist, but how much more is unknown.

The vegetation would remain in its present undisturbed state, with the exception of approximately 15 acres which would be disturbed by the construction of seven reservoirs, four water catchments, 2.6 miles of access road, and 1 mile of stock trail as part of a proposed allotment management plan (AMP). The AMP would combine the Lloyd and Cottonwood-Rapid Creek allotments into the Lloyd allotment, and institute a rest rotation grazing system. The number of cattle run on the allotment would be decreased from 128 to 86, but the cattle would be kept on the allotment a longer period of time; therefore, the total AUMs of forage would remain 278. Implementation of the proposed AMP may improve the vegetative condition of the coal lease area by increasing the density of key species (western wheatgrass, galleta grass, and big sagebrush). The primary use of the vegetation would remain livestock and wildlife forage.

Continuing human population growth in Mesa County would still cause impacts to wildlife: expansion of urban areas onto agricultural lands and some winter range; increased recreational use of wildlife species, primarily hunting; and increased poaching of big game species.

Natural weathering and vandalism would continue to be the major causes of loss of archeological and historical values, but there should be no additional contributing factors to such loss at the site if the M&R plan is rejected. Paleontological resources would be impacted both adversely and beneficially in approximate proportion to the level of regional development and the area disturbed.

The population of Mesa County would still increase at a rapid rate to 88,050 people in 1980, 108,290 people in 1985, and 109,780 people in 1990. Development of oil shale and uranium and the area's role as a regional center account for the growth. Garfield County is also projected to grow at a rapid rate to 34,040 people in 1980, 42,420 people in 1985, and 46,050 people in 1990, also primarily as a result of oil shale development.

Mesa and Garfield counties, towns, special districts, and the school district would not receive increases in revenue amounting to $167,180 in 1980, $1,803,460 in 1985, and $2,032,280 in 1990. Of course expenditures to provide facilities and services to accommodate population increases associated with Cottonwood would not have to be made. Total income in the county would be reduced by $1,261,600 in 1980, and $10,092,800 in 1985 and 1990.

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transports, and rates of production have been considered but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geology and geographic characteristics of the area. Any new alternatives presented by the review process will be carefully considered.

GENERAL EXPLORATION COMPANY:

CAMEO NO. 1 AND NO. 2 MINES

CHAPTER 1

DESCRIPTION OF THE PROPOSAL

Proposed Action

The proposed action is the review and consideration for approval of a mining and reclamation plan (M&R plan) submitted by General Exploration Colorado Company (GEX) on February 22, 1978, to the Area Mining Supervisor of the U.S. Geological Survey (USGS), Denver, Colorado. The M&R plan has been accepted by the USGS as suitable for use in preparing this environmental statement (ES) and is available for public review at the Area Mining Supervisor's Office in Denver.

This mining and reclamation plan was submitted for review after promulgation of the initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) but has not been officially reviewed for compliance with that act. The applicant's plan may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations.

The M&R plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The M&R plan cannot be approved until it conforms to all applicable federal requirements.

The plan describes the proposed Cameo No. 1 and Cameo No. 2 mines which are to be located about 3 miles northeast of Palisade, Colorado in Mesa County. The underground coal mining operation would produce 1.6 million tons of coal annually using an estimated 400 employees at full production. Coal would be mined from the Cameo B coal seam from federal coal lease C-01538 and adjacent private reserves totaling 4,814.72 acres (see map G1-1). The federal lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.

Total estimated federal coal reserves that are recoverable by underground mining methods are 30 million tons of coal. The estimated mine life would be approximately 47 years. Coal produced from the mines would be transported by rail to utility markets in the midwest.

History and Background

Production from the Little Bookcliffs area was first recorded in 1890. Several underground mines produced 900,422 tons from the Palisade seam through 1969, including the Mount Lincoln Mine, the Gearhart Mine, the Garfield Mine, the Palisade Mine, and the Riverside Mine. Most recently the Coal Canyon Strip Mine operated in 1963, 1968, and 1969, producing 69,152 tons by both strip and auger methods from the Cameo-Carbonera interval of the Palisade seam. The largest past producer was the Cameo No. 1 Mine, which produced 4.2 million tons from 1899 to 1969.

In the early part of 1977 GEX began work on construction of the Cameo No. 1 Mine incline. This incline was completed in January 1978, is totally on private lands, and will be used for access to the Cameo B seam by GEX-Colorado. The open cut has a decline of 12.5 percent for about 600 feet to the highwall. From the highwall, a rock tunnel on a decline of 15 percent should intersect the Cameo seam at a distance of about 225 feet.

Predisturbance Inventories and Analyses

At the request of GEX, the U.S. Soil Conservation Service has completed an inventory of the soils and vegetation of the Cameo No. 1 and No. 2 Mine areas to be disturbed. The Bureau of Land Management (BLM) also completed a vegetative study of the area along with a threatened and endangered plant literature search and herbarium inventory. The Colorado Division of Wildlife has completed a wildlife study and survey. Since most of the area of the portals of the mines have been previously disturbed by past mining, no archeological survey is contemplated by the company for its private lands. Should its plans later change and involve surface disturbance of public lands, then GEX will be required to survey the areas of disturbance on the public lands.

Stages Of Implementation

GEX proposes to begin producing, by room-and-pillar methods, approximately 200,000 tons of coal in 1978 from the Cameo No. 1 Mine with approximately 100 employees. Production will increase stepwise until full production of 1.6 million tons of coal annually with approximately 400 employees is reached in 1989 from both the Cameo No. 1 and No. 2 Mines; initial production would be from private property.

Construction of the mine support buildings will start in 1978 with the rail loadout to be completed by late 1978 or early 1979. The overland conveyor from the Roadside Mine (another GEX operation discussed in the regional section) is under construc-

——— FEDERAL LEASE

- - - - PRIVATE LEASE

(B) PRIVATE SURFACE, PRIVATE MINERAL

(C) PUBLIC LAND SURFACE, FEDERAL MINERAL

Map G1-1. General Exploration's Cameo lease area

tion and is expected to be completed by late 1978. This conveyor will also be used for coal haulage from the Cameo No. 1 and No. 2 mines.

Coal will be produced from the Cameo B seam, the same seam from which the Roadside Mine is producing. Exploration drilling on the subject area has indicated the presence of five other coal seams. These seams are, from top to bottom, Cameo F, E, D, C, and the Palisade; the Anchor seam is thought to be present, but drilling has not been deep enough to prove or disprove its presence. The company states that the Cameo F, E, and D seams are not of quality or quantity to be considered as economical to develop under present mining requirements. Also, the Palisade seam is of mineable quantity, but quality precludes mining of the seam under present requirements. (Figure G1-1 is an aerial photograph of the Cameo area.)

Mine Layout

CAMEO NO. 1 MINE

Initial development of the Cameo No. 1 Mine was an opencast decline approximately 650 feet north-south by 380 feet east-west in Section 27 T. 10S. R. 98 W. 6th P.M. The portal would be approximately 1,700 feet north of the abandoned Cameo Mine. The floor of the pit is inclined 12.5 percent, for 600 feet horizontally, to the toe of the highwall. From the highwall, three rock tunnel entries, approximately 20 feet wide and 10 feet high, are driven approximately 225 feet on a 15 percent decline intercepting the Cameo B seam. (Map G1-2 shows the mine plan.)

Once the initial three entries have intersected the Cameo B seam, an additional entry would be driven off to each side in a wishbone pattern (see figure G1-1). The resulting five entries would then be driven 160 feet further north. At that point, an additional entry would be driven off to each side, creating a total of seven entries. These seven entries, designated the No. 1 North Main, would then be driven a final 4,200 feet north. Entries and crosscuts would be 20 feet wide by 10 feet high on 120-foot and 75-foot centers respectively. This pattern would create 100-by-55-foot main entry chain pillars.

At a distance of 1,400 feet in from the portal along the No. 1 North Main, a seven entry main system would be driven east. This main would be designated the No. 3 East Main and it would be driven about 3,000 feet east to the Denver and Rio Grande Western (D&RGW) right-of-way. The entries and crosscuts of the No. 3 East Main would be developed perpendicular to each other on 140-by-85-foot centers leaving 120-by-65- foot main entry chain pillars. Entries and crosscuts would be 20 feet wide by 10 feet high. At a distance of about 2,350 feet from the No. 1 North Main, the No. 3 East Main would be turned north from the No. 3 East for about 3,850 feet to the limit of the mineable Cameo B seam.

Finally, the room-and-pillar panels would be driven off of the No. 3 East Main. At a distance of 600 feet along the No. 3 East Main from the No. 1 North Main, a five-entry main would be driven south to develop a room-and-pillar panel. About 1,900 feet along the No. 3 East Main a second room-and-pillar panel would be developed to the north.

About 3,400 feet from the portal along the No. 1 North Main, a three-entry system would be turned west to develop a small room-and- pillar panel. Just north of this panel, at a distance of 4,200 feet from the portal, the No. 2 West Mains would be driven for 11,300 feet to a barrier pillar to be left at the property boundary. Although no specifications for the No. 2 West Main have been given, the entries and crosscuts would probably be 20 feet wide on 150-by-80-foot centers, leaving 130-by-60-foot chain pillars. Four sets of five-entry mains would be driven north from the No. 2 West Main at distances of 2,000, 4,600, 7,300, and 9,000 feet from the No. 1 North Mains. Each of these four sets of five-entry mains would be used to develop large room-and- pillar panels (approximately 3,600 by 2,400 feet). South of the No. 2 West Main the pattern of room-and-pillar panels would be more irregular. At a distance of 3,300 feet from the No. 2 West Mains, a five-entry main would be driven south to develop a small room-and-pillar panel. A second small room-and-pillar panel would be developed through a three- entry main at a distance of 5,400 feet from the No. 2 West Mains. Finally, at distances of 7,200 and 9,800 feet from the No. 2 West Mains, two sets of five-entry mains would be driven south to allow mining of two 3,600-by-2,400-foot panels.

All development of the Cameo No. 1 Mine would be done in advance. All room-and-pillar panel pillars would be mined on retreat. All main entry barrier and chain pillars would be mined on retreat from the mine.

CAMEO NO. 2 MINE

The location for the portal of the Cameo No. 2 Mine is not yet fixed precisely. However, an area approximately 4,300 feet southwest of the abandoned Cameo Mine has been tentatively chosen. The Cameo No. 2 Mine would enter the Cameo B seam with a set of three horizontal entries from the seam outcrop. These three main entries would be increased to seven main entries in the wishbone pattern established at the Cameo No. 1 Mine. From the seven initial main entries which are to be driven west, at a distance of 1,000 feet from the portal, five entries would be driven off at a 60

Figure G1-1. Looking northeast up DeBeque Canyon from just south of Palisade, Colorado. The Little Bookcliffs escarpment and the abandoned Mt. Lincoln Mine are in the foreground. Point B indicates General Exploration's Roadside Mine, and point C indicates the site of the company's proposed Cameo No. 2 Mine. The existing portals of the Cameo No. 1 Mine lie just off the upper left-hand corner of the photo. (This view lies directly north of the area shown in figure MB1-1, in the Mid-Continent Cottonwood Creek site-specific analysis.)

degree angle to both north and south. Both sets of five entries would be used to develop large odd-shaped panels for room-and-pillar mining. Along the initial seven entries at a distance of 6,100 feet from the portals, a second set of five entries would be driven directly north. These entries would be used to develop a 2,000-by-2,800-foot panel for room- and-pillar mining. At a distance of about 7,000 feet from the portal, a third set of five entries would be driven north to develop a 3,500-by-2,000-foot panel.

All development in the Cameo No. 2 Mine would be on advance and the coal mined on retreat. Main entry barrier and chain pillars would be mined on retreat.

VENTILATION

In both the Cameo No. 1 and No. 2 Mines, the left main entries would be for intake air, the right main entries for return air, and the middle main entry for the belt conveyor. The ventilation of both Cameo No. 1 and No. 2 would be negative pressure type. Initially, a 6-foot fan would be installed at the Cameo No. 1 in fire-proof housing and connected to the right hand entry (return) by fireproof ducting. The fan-housing would be on the highwall of the decline to eliminate the possibility of exhaust recirculation through the left (intake) entry. A second 6-foot fan would be installed parallel to the original fan after the second year to supplement volume capacity. After the third year, an exhaust shaft approximately 400 feet deep would be developed. This would be for the permanent fan installation; the two 6-foot fans on the highwall would be removed and the exhaust entry converted to another intake entry. The ventilating fan would be in continuous operation except for scheduled maintenance, adjustment on idle days, uncontrolled stoppage, or fan failure.

Ventilation in sections and at working faces would be such that at least 10,000 cfm would reach a working face if diesel equipment is used or 8,000 cfm if belt haulage is used. Ventilation would be carried to within 10 feet of a working face by vent tubing. Permanent substantial, non-combustible stopping would be erected between intake and return air courses from the third connecting cross-cut out from a working face. Brattice line cloth would be used as a temporary stopping from the third connecting crosscut to the face to maintain proper ventilation. Auxiliary fans would be used to assist ventilation in working areas.

Ventilation for the Cameo No. 2 Mine would be similar to that of the Cameo No. 1, except that the Cameo No. 2 Mine ventilation would be horizontal entry with the fan offset from the right (return) entry. Also, an exhaust shaft is not anticipated for the Cameo No. 2.

ROOF AND FLOOR CONTROL

Roof control would be by use of both standard and resin type roof bolts on not more than 5-foot centers in all areas. Additional roof support would be by use of wood header blocks, wood logging, wire mesh, and aluminum cross bars not less than 15 feet in length.

HAULAGE SYSTEM

Coal would be removed from a working section either by diesel- powered buggies or Long-Airadox conveyor system. Coal would be removed from a working panel and from the mine by 48-inch wide conveyors and deposited in 18,000-ton storage piles. The coal would then be transported to the preparation plant, to clean coal storage, and the unit-train loadout area by a covered conveyor belt system.

Coal from Cameo No. 2 would be handled similarly to that of Cameo No. 1, with the coal being transported from the Cameo No. 2 portal by conveyor and deposited on the raw coal storage pile.

Surface Facilities

Approximately 223 acres would be disturbed initially for support buildings, preparation plant, unit-train loadout, railroad spur, conveyor system, refuse disposal, electric power supply system, test plot, industrial area, and access roads. Permanent disturbance of the Cameo operation would be 118.5 acres. Map G1-2 depicts locations of the facilities. The unit-train loadout, railroad spur, and overland covered conveyor would also be used by the Roadside Mine (discussed in the regional analysis), which is operating under an approved mining plan.

Data for a water supply system and sewage treatment facility were not given but will be submitted at a later date. GEX does have a water right of 56 acre-feet per year from the Colorado River.

CONVEYOR FROM PREPARATION PLANT

The covered conveyor from the preparation plant would tie into the covered conveyor from the Roadside Mine. Less than 1 acre of disturbance would be involved.

RAILROAD LOADOUT AND CONVEYOR FROM ROADSIDE MINE

The railroad spur from the D&RGW, unit-train loadout facilities and covered conveyor from the Roadside Mine (presently under construction) would temporarily disturb about 86 acres. Approximately 11.3 acres of this would be permanently disturbed.

PREPARATION PLANT

Approximately 43.5 acres would be temporarily disturbed by the preparation plant, accompanying

support buildings, and the Cameo No. 1 Mine portal facilities. Permanent disturbance of about 19 acres would be due to a security building, parking area, administration building, repair shop, storage yard, bathhouse, warehouse, and portal facilities. In addition, approximately 6.7 acres would be permanently disturbed by the 10,000 ton raw coal storage pile, preparation plant, conveyor system, refuse bin, and clean coal storage bin.

REFUSE DISPOSAL

Approximately 51.1 acres would be disturbed for disposal of refuse from the mining operations and the preparation plant. The refuse pile would be constructed so that slopes would be a maximum of 27.5 degrees to avoid slides, refuse pile slippage, or stream pollution and would comply with 30(CFR): 700 regulations.

TEST PLOT

Approximately 8.3 acres of a 23.1-acre test plot would be permanently disturbed by an office building, parking area, and testing building.

INDUSTRIAL PARK

An industrial park consisting of warehouses, storage yards, and parking area would disturb approximately 11.5 acres permanently.

CAMEO NO. 2 MINE

Approximately 10 acres of surface would be permanently disturbed at the portal site and by a covered conveyor and maintenance road from the Cameo No. 2 Mine to the raw coal storage pile at the Cameo No. 1 Mine; approximately 0.7 acres would be required for the portal facilities.

DRAINAGE SYSTEM

At the present time, GEX has not designed a drainage system for the mine site. Before the M&R plan can be approved, the company will have to design a system to comply with regulation in 30(CFR): 717.

Surface Reclamation

Prior to disturbance of any area, all available topsoil would be removed and stockpiled where possible. If required, the topsoil stockpiles would be planted with an annual and/or perennial seed mix.

After mining is completed, the property would be prepared for abandonment by removal of all structures, backfilling of portals (after sealing) and decline areas, grading of all disturbed areas to approximate original contour, scarifying of all access and maintenance roads, replacing all available topsoil to a minimum of 1-inch depth, fertilizing if necessary, and revegetating the disturbed areas with approved seed and plant mixtures. The Cameo No. 1 and No. 2 mining operations will be required to reclaim all disturbed lands to a condition capable of supporting the prior land use before mining commenced, or to a land use of higher or better condition. A mining permit will not be approved until the applicant has demonstrated that the reclamation plan contained in the M&R plan can restore the land areas affected to the proposed post mine land use.

Authorizing Actions

This mining and reclamation plan was submitted for review after promulgation of initial regulations, 30(CFR): 700, required under Section 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), but it does not fully reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the plan was designed using the requirements of the initial regulations. Before the plan is approved by the Department of the Interior, it will be returned to the mining company for redesign to incorporate the applicable initial regulations. As soon as the applicant's plan is revised and returned to the USGS, it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations at 30(CFR): 211 and 30(CFR): 700. The mining and reclamation plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is governed by the regulation 30(CFR): 715.15. The standards and measures described in these regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

Federal Agencies

Before approval of the M&R plan is granted, BLM must concur with GEX's proposal following redesign according to 30(CFR): 211 and 30(CFR): 700 regulations and review by USGS and OSM.

USGS would with BLM concurrence approve the M&R plan.

OSM would review the M&R plan and, following redesign according to 30(CFR): 700 regulations, approve it along with USGS approval and BLM concurrence.

State and County Agencies

Air quality, solid-waste disposal, water quality, and mining and reclamation of mineral land must comply with rules and regulations administered by the various divisions within the Department of Natural Resources. GEX has already obtained air quality and NPDES permits from the state of Colorado; however, approval of the M&R plan, and some additional permits and licenses must be obtained form the state of Colorado to mine coal.

GEX would have to obtain necessary permits from Mesa County and comply with stipulations given by the county.

Interrelationships

Relationship to Other Existing and Proposed Developments

The Roadside Mine, which is also operated by GEX, is the only active mine in the area of the proposed Cameo No. 1 and 2 mines. The Roadside Mine lies approximately 0.5 to 0.75 mile southeast of the proposed site for the Cameo mines. Annual production from the Roadside Mine was 300,200 tons of coal from both private and federal leases in 1977. Construction of a covered overland conveyor from the existing Roadside Mine to the new unit train loadout facilities for the proposed Cameo Mines is under way. Further discussion of new facilities is provided in the proposed action. Currently coal is trucked from the mine to purchasers.

The Cameo steam electric plant of the Public Service Company of Colorado is adjacent to the proposed Cameo Mines.

Besides the proposed Cameo Mines, two additional proposed new mining operations to be located in the Palisade area are being considered in separate site-specific volumes of this ES. The first, the proposed Cottonwood Creek No. 1 and 2 mines, lies approximately 1.25 miles south of the proposed Cameo site. Initial development for the Cottonwood Creek mines would be from the existing Roadside Mine. This mine is scheduled to produce 1 million tons per year by 1985. The second, the proposed Coal Canyon Mine, lies approximately 2.5 miles southwest of the proposed Cameo mines. The Coal Canyon Mine is scheduled to produce 500,000 tons per year by 1989.

The D&RGW main line, which parallels Interstate 70 and the north bank of the Colorado River, is immediately adjacent to the Cameo property. The unit train loadout facility which GEX is constructing would also be used by both the Mid-Continent mines which are proposed; figure G1-2 shows the site.

Housing and service facilities exist in the area in Palisade and in Grand Junction. Experienced labor is in short supply in the area because agriculture is the mainstay of the area.

Relationship to BLM Land Use Plans

The 2,560 acres of public lands included in this M&R plan are administered by the BLM's Grand Junction District. They are subject to the management guidelines that were developed in the Roan Creek-Uinta Flats management framework plan (MFP) completed in January 1971, and the Grand Junction Resource Area Coal Update MFP, completed in September 1977.

The surface overlying GEX's lease holdings has been used for livestock grazing in the past. Some recreation use occurs in the form of four-wheel driving and hunting. As pointed out in History and Background in chapter 1, coal was mined in this area for a number of years.

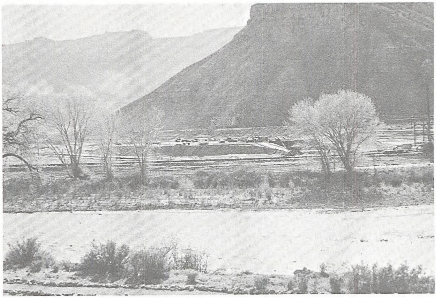


Figure G1-3. The loadout facilities being constructed by General Exploration in the Cameo area would be used for the company's Cameo mines and Mid-Continent Coal and Coke's Coal Canyon and Cottonwood Creek mines.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, and cultural resources and the socioeconomic conditions which constitute the site-specific environment in which General Exploration Company (GEX) proposes to develop federal coal and adjacent private coal. The description focuses on environmental details most likely to be affected by GEX's proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunderstorms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air move ments.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Cameo mine site is located at the mouth of DeBeque Canyon near the community of Cameo and on the edge of Grand Valley. Elevation at the site ranges between 4,800 and 5,200 feet. No meteorological measurements are made on site. Data from the Grand Junction weather station indicate that the average annual temperature is 53 degrees Fahrenheit, and annual precipitation is about 8 to 9 inches. The growing season is 188 days (based on 32-degree freeze threshold data). Evaporation is estimated to be about 45 inches annually.

Prevailing wind at this site is influenced by its location in DeBeque Canyon. No wind measurements are made on site. It has been assumed that prevailing wind direction is down valley or from the northeast. The wind rose from the nearby Grand Junction weather station has been rotated to reflect the major canyon axis, as shown in figure G2-A. Average wind speed at the Grand Junction station is 8.1 miles per hour.

Air Quality

Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations range from 20 to 40 $\mu g/m^3$.

The available particulate sampling data which best represent existing particulate air quality at the proposed Cameo mine are from a state-operated sampler located about one mile northeast of the site in DeBeque Canyon. The annual geometric mean concentration recorded at the sampling site is 42 $\mu g/m3$ with first and second maximum 24-hour concentrations of 158 and 132 $\mu g/m3$, respectively. These concentrations also reflect the impact of an existing mine (Roadside) and the power plant located nearby.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutants near the proposed site. The power plant and motor vehicle emissions near the mine site are likely to affect concentrations of these pollutants. However, the degree of impact is unknown.

Visibility at the site ranges from less than 1 mile to approximately 100 miles throughout the year. Average visibility is about 54 miles with greatest visibility occurring during spring and summer months.

Geologic Geographic Setting

Topography

The private and federal coal leases that compose the Cameo mine property lie northeast of the Little Bookcliffs and Grand Valley. These leases extend from DeBeque Canyon (and the Colorado River) to just west of Mt. Lincoln. Elevation varies from 4,760 feet along the Colorado River on the southeastern property boundary to 6,649 feet on the

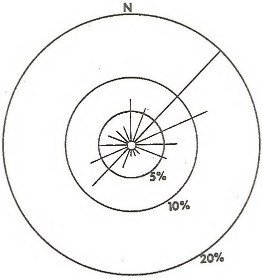


Figure G2-A. Annual wind frequency at the Cameo mine site

summit of Mt. Lincoln on the southwest property boundary.

Along the portion of its course that occupies DeBeque Canyon, the Colorado River is bound by steep V-shaped canyon walls. Local relief along the canyon walls may approach 1,200 feet. South of the Colorado River lie the northern slopes of Grand Mesa, and north of the river lies the southern end of the Little Bookcliffs escarpment. The mine property consists of a predominantly northeast trending ridge system dissected by two major drainages, Main Canyon and Coal Canyon. At intervals the canyon walls are notched by small, intermittent stream channels. Both Jerry Creek (lying in Main Canyon) and Coal Canyon Creek are tributaries of the Colorado River.

The maximum relief on the mine property occurs along the escarpments of DeBeque Canyon and Main Canyon. Slopes may reach up to 75 percent on the canyon walls, and for short segments vertical cliffs are not uncommon. The average slope throughout the lease area is 55 percent. Along major stream channels slope may be as little as 4 to 5 percent.

Landforms

The landforms present on the lease area are largely the result of the differential erosion of the sedimentary strata of the Mt. Garfield formation. Thick resistant sandstones form vertical cliffs and escarpments. Shales and other less resistant beds form gentle slopes between the cliffs and ledges. Because of the predominance of sandstones in the Mt. Garfield, narrowly cut canyons and steep slopes are the major landforms in the area.

Structure

The structural geology of the mine property of the lease area is relatively simple. The sedimentary strata of the Mesaverde formation dip to the north-northeast at an angle of 3 degrees in the vicinity of the Cameo mine property. No major faults have been identified in the area.

Sandstone dikes or rock spars are characteristic of the Cameo coal zone in the Palisade area. They appear unpredictably in the old Cameo Mine and are present in other mines in the area. The dikes are extremely hard, cemented sandstone, requiring drilling and blasting for removal. Although usually only a few inches thick, they sometimes reach several feet in thickness. The dikes are thickest at the base, tapering generally to the top of the seam. Their attitude is nearly vertical, and their direction is random with no distinct orientation. Although creating an occasional nuisance to the mining operations with interruptions in the mining cycle, the dikes do not present an insurmountable obstacle and can be handled effectively when encountered if the mining equipment is properly designed.

Stratigraphy

The main coal beds on the lease area are found in the Upper Cretaceous Mesaverde group which is overlain by the early Tertiary Ohio Creek conglomerate and underlain by the Upper Cretaceous Mancos shale. Locally the Mesaverde is 4,100 feet thick and is composed of the Mt. Garfield formation and the overlying Hunter Canyon formation.

There are four coal zones containing workable coal seams in the Palisade area. These are, in ascending order, the Anchor and Palisade coal zones of the Mancos shale and the Cameo and Carbonera coal zones of the Mt. Garfield formation (see figure G2-1). Of the four zones present in the area, the company states only the Cameo coal zone can be considered mineable under the Cameo mine property at this time. The Cameo coal zone is the lowest coal zone of the Mt. Garfield Formation and lies directly on the Rollins sandstone, the bottom member of the Mt. Garfield formation. The Cameo coal zone consists of the Cameo B and C seams; where the two coalesce, the seam is called the B seam. GEX proposes to mine only the B seam. The overlying coal seams of the Carbonera are considered too lenticular and discontinuous to be mineable. Data from of exploration drill holes indicate that the roof will be sandstone, shale, or unmined bony or shaley coal. This suggests that roof conditions will be generally favorable.

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be considered in the environmental statement (ES) process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table G2-1. Due to the present lack of data and accepted criteria for determining significance, the importance of these paleontological resources to science, education, and other values cannot presently be assessed.

The BLM and U.S. Geological Survey (USGS) are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

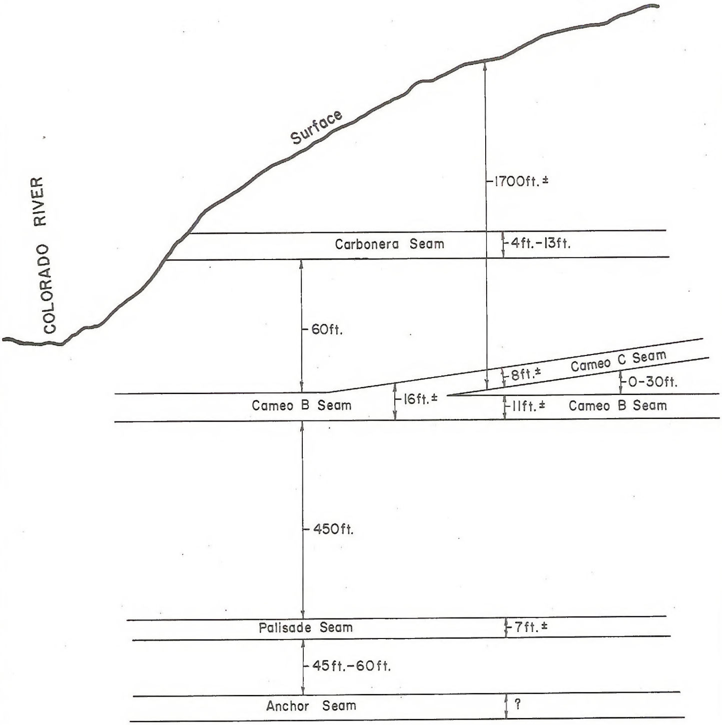


Figure G2-1. Schematic of coal seams of the proposed Cameo No. 1 and No. 2 mines

TABLE G2-1

SUMMARY OF FOSSIL-BEARING FORMATIONS IN THE AREA
OF THE PROPOSED GENERAL EXPLORATION MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils b/
Mancos Shale	Cretaceous	General	I, V, P
Mt. Garfield	Cretaceous	General	I, V, P
Hunter Canyon	Cretaceous	General	I, V, P
Ohio Creek	Tertiary	General	I, V, P
Wasatch	Tertiary	General	I, V, P

a/ General = Formation contains fossils throughout; specific localities are not identified.

b/ I = Invertebrate; V = vertebrate; P = paleo botanical.

Mineral Resources

Coal

The Cameo B seam, which GEX proposes to mine, ranges from 6 to 11 feet with an average thickness of 9 feet. Reports from the U. S. Bureau of Mines for the abandoned Cameo Mine show that the weighted average on as-received mine run coal was 11,773 BTUs, 0.64 percent sulfur, 7.92 percent moisture, 9.58 percent ash, 46.94 percent fixed carbon, and 35.56 percent volatile matter. The USGS estimated the total in-place coal reserves for the proposed Cameo mine as 45.82 million tons of coal; the USGS estimated a total of 73.78 million tons of coal reserves under lease C-01538.

Oil and Gas

A slight potential exists for oil and gas under the leased land. A well is to be spudded-in in the near future approximately 3.5 miles to the southwest.

Water Resources

Surface Water

The lease area lies adjacent to the west bank of the Colorado River approximately 2 miles upstream of Palisade, Colorado. Records from a river gauging station (No. 09095500) located 7 miles northeast of the municipality of Cameo, Colorado, show that the average annual discharge of the Colorado River is 3,864 cubic feet per second (cfs), or 2,799,000 acre-feet. Peak flow in excess of 11,000 cfs occurs during May and June as a result of melting snowpacks. The lowest flow on record is 700 cfs on December 19, 1939.

Surface water flow through the project area is ephemeral. Perennial flow only occurs in the adjacent Colorado River, Government Highline Canal, and Orchard Mesa Canal. The ephemeral drainages which drain through the area are Coal Canyon (11.7 square miles), Jerry Creek (68.8 square miles), and Asbury Creek (8.4 square miles). These natural water courses are dry about 95 percent of the time. However, resulting from summer thunder storms, flow rates of 9 to 77 cubic feet per second (cfs) can be expected from time to time. Maximum expectable flood discharge ranges from 80 to 15,000 cfs. The highest flow rates recorded for Jerry Creek and Coal Canyon by the U.S. Geological Survey are 12,000 cfs and 3,440 cfs, respectively, which occurred on July 18, 1974. A general description of the Colorado River, adjacent to the lease area, can be found in the regional volume.

Ground Water

No specific ground water data are available for the Coal Canyon area. However, the Rollins sandstone is located within the lower Mesa verde formation, which is the source of many springs and wells. The ground water flow in this formation is controlled by interstitial porosity, that is, water is contained and transmitted through interconnected pore spaces between grains within the sedimentary bedrock. Water yields from the formation vary between 0 and 50 gallons per minute (gpm), but generally average 10 gpm.

Cameo is currently discharging mine water into Coal Creek under NPDES Water Permit (no. CO-0035467). This permit will allow a maximum discharge of 1,440,000 gallons per day (gpd) into Coal Creek, and subsequently into the Colorado River. If this maximum discharge rate is obtained by Cameo from within their mines, the total annual discharge from the aquifer will be 1,614 acre-feet. An unknown quantity of mine water is currently being discharged into Coal Canyon.

Water Quality

When runoff water flows through these ephemeral drainages in response to summer thunderstorm, the water level rises and falls rapidly, termed 'flash flooding.' As these flash floods move down the channel, they first scour and then fill the channel bottom, and then leave flood deposits on the valley floor after they recede. The resultant quality of these flash flood waters can be classified as very poor with suspended sediment loads typically in the tens of thousands parts per million.

The quality of the ground water from the Mesaverde formation can be expected to be of poor quality. In general it is a sodium-chloride-bi- carbonate type described as 'very hard.' Analysis of water throughout this aquifer shows that excessive iron, manganese, sulfate, and fluoride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1974, Price and Arnow 1974, and Brogdon and Giles 1977). Typically the water is of poor chemical quality for domestic or public uses. General Exploration Company is currently discharging ground water from its portal into Coal Creek under NPDES permit no. CO-0035467. This poor quality water then runs 1,000 feet and dumps into the Colorado River. The quantity of water currently being discharged is not known. However, the maximum allowable under this permit is 1,440,000 gpd (4.4 acre feet per day). Mine water is also being discharged out of old mine workings.

Soils

Soil mapping units in areas of existing and proposed surface disturbance are delineated in figure G2-2.

Existing disturbance consists of approximately 74 acres within mapping unit 80 (rough broken and stony land) and 90 acres in unit 45-A (Green River

loam, 0 to 3 percent). New disturbance would be limited to approximately 69 acres in unit 80.

Unit 80 is not strictly defined but includes various components ranging from shallow loamy soils and rock outcrops on steep side slopes to deep, fine-textured soils on flatter valley bottoms. Unit 45-A is a coarse-textured alluvial soil on the Colorado River flood plain; this soil is commonly used as irrigated cropland but has not yet been formally classified as prime farmland.

Specific soil features of importance in assessing reclamation are rated in table G2-2; brief explanations of each rating are contained in the footnotes.

Vegetation

The vegetation on the coal lease tract consists of five vegetation types: pinyon-juniper, saltbush, sagebrush, riparian, and greasewood (see map G2-1). Pinyon-juniper and saltbush are the most widespread types in the lease area. Pinyon-juniper occurs on level mesas and north-facing slopes, while saltbush is in canyons and on south-facing slopes. The dominant species within the saltbush type is shadscale; galleta and snakeweed are locally abundant. Some steep, rocky south-facing slopes in the saltbush type are nearly barren of vegetation.

Level areas with well-developed soil support extensive stands of big sagebrush in the coal lease area. These sage parks are usually bordered by pinyon-juniper woodlands.

The riparian vegetation is on the flood plain of the Colorado River. It is composed of cottonwoods, willows, saltcedar, and a number of herbaceous grasses and forbs. The greasewood type occurs sporadically along the drainages of Coal Canyon, Coal Gulch, and Jerry Creek. The dominant plant is black greasewood. No data are available on aquatic vegetation in the area proposed for mining.

The land where the mine portals and associated surface facilities would be constructed is currently disturbed and contains no natural vegetation other than weedy species, with the exception of the proposed refuse area, which is in the saltbush type.

A more detailed discussion of the plant species composition of these vegetation types as well as their relationships to climatic and topographic features and to each other can be found in the regional analysis. Scientific names of the plants discussed are in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the *Federal Register* (see table R2-10 in the regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State University, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Cameo Mine. The results of the literature and herbarium studies may be seen at the BLM Montrose District Office. A detailed floristic and endangered and threatened plant inventory of the natural vegetation that is expected to be disturbed by the Cameo mine facilities and roads has revealed that no endangered or threatened plants are present. The results of this inventory are available for public review at the Grand Junction District Office.

Wildlife

All terrestrial species known or expected to occur in the Cameo area are listed in appendix C. The area for the Cameo No. 1 portal and for the loadout facility have already been cleared and construction is under way.

Wild Horses

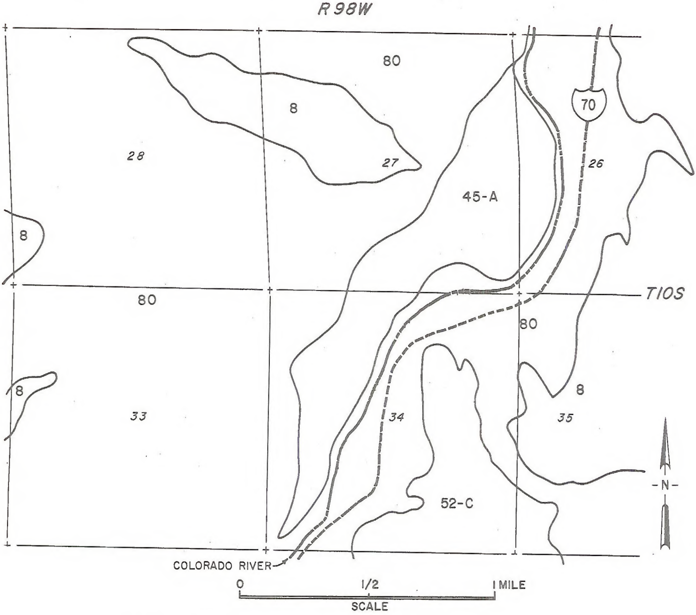
The Little Bookcliffs Wild Horse Area is northeast of the Cameo facilities, and some underground operations would occur within the Wild Horse Area. The horses do occasionally winter in Main Canyon in the northeast corner of the lease tract. The current population of horses is around 70 animals, following the removal of 40 head in the fall of 1977. South-facing slopes are the areas most used by the horses due to the lack of snow accumulation. (See map G2-2.)

Big Game

MULE DEER

Coal Canyon, Main Canyon, and Jerry Creek are on the southern edge of the Roan Creek deer herd's winter range (see map G2-3). Based on pellet group transects, 29.8 deer days of use per acre occur near the Cameo lease. Deer normally move into this area in mid-November and remain until April, when they gradually migrate to higher elevations. Use adjacent to the Cameo No. 1 facilities is generally restricted to this seasonal migration and movements to water. This is because of the highway, railroad, Public Service Company, and the ongoing construction by General Exploration.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average



MAPPING UNITS

8	Rock outcrop
45A	Green River loam, 0-3% slopes
52C	Utaline stony loam, 3-25% slopes
80	Rough broken and stony land

Figure G2-2. Soil units in the area of the proposed Cameo No. 1 and No. 2 mines

TABLE G2-2

SOIL FEATURES FOR GENERAL EXPLORATION MINING AREA

Mapping Unit No.	Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
45A	Green River Loam, 0-3% slopes	B	Slight	Good	Slight
52C	Utaline stony loam, 3-25% slopes	B	Moderate-High	Poor	Severe
80	Rough broken and stony land				
	Rock outcrop	--	--	--	--
	Lazear	D	High	Poor	Severe
	Scholle	B	Moderate	Fair	Moderate
	Saraton	B	Moderate	Fair-Poor	Severe

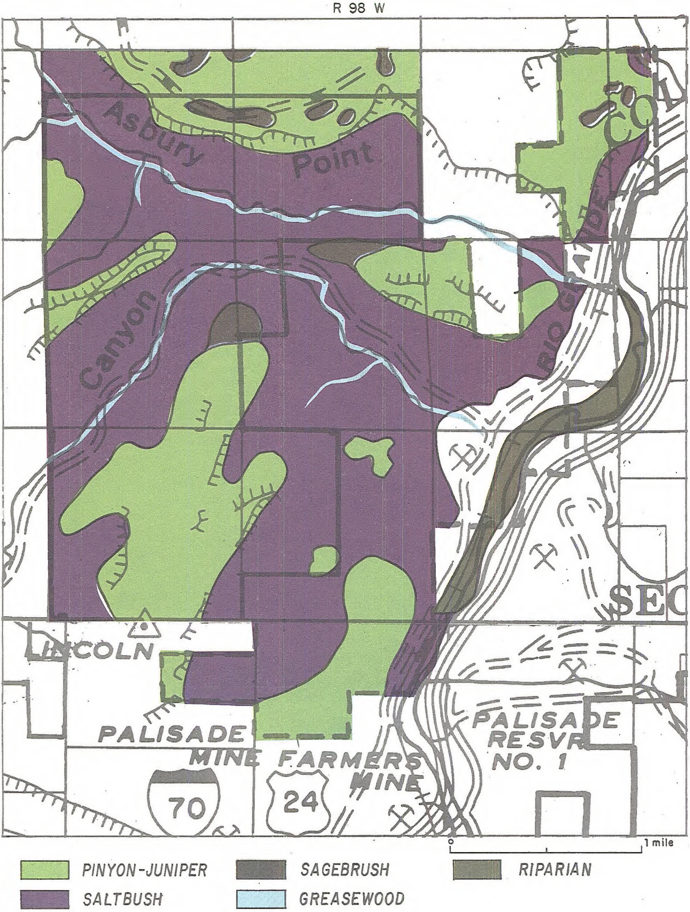
Note: Adapted from data provided by U. S. Department of Agriculture, Soil Conservation Service, Grand Junction, Colorado.

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic and soil conditions which produce extreme surface erosion or landslide hazards.



Map G2-1. Vegetative types in the area of the proposed Cameo No. 1 and No. 2 mines

number. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer population within the Cameo lease area of about 375 animals during the winter months.

Small Mammals

Due to the ongoing construction of Cameo No. 1 facilities and the loadout, there are very few small mammals remaining in these two areas; and those that are there at present are those adapted to human presence. The remaining areas of the Cameo lease have species composition that is typical of the pinyon-juniper, sagebrush, and saltbush habitats in western Colorado. Cottontail rabbits, chipmunks, mice, and rock squirrels are some of the more common species. Small mammals closely associated with aquatic habitat, such as beaver, muskrat, and raccoon, occur along the Colorado River. Coyote, bobcat, and ringtailed cat are the predatory species found in the vicinity of the lease.

Game Birds

Mourning doves are the most common game birds found in the area. During the summer, doves nest throughout the area, utilizing trees or the ground as nest sites. They concentrate around weed patches, road shoulder, and small seeps or stock ponds.

Chukars, an introduced species, are found throughout the canyon. Steep rocky slopes, cheatgrass (Bromus tectorum) and water sources are important habitat components for this species.

Sage grouse are also located in the vicinity of the lease. Sagebrush parks with a mixture of different heights of sagebrush are essential to the survival of this species because of their dependance on the leaves of sagebrush for their diet.

Mallards and Canadian geese nest and raise their young along the Colorado River in DeBeque Canyon. During spring and fall migration and the winter months, a much greater variety of waterfowl is present on the river, with the common merganser and common goldeneye two of the most abundant species. 1Other Birds

The abundance of cliff faces and the height of the canyon walls provide excellent nesting habitat for golden eagles, prairie falcons, and redtailed hawks. These species do nest outside Coal Canyon, and they would be expected to spend time hunting within the Coal Canyon drainage as the area is within normal hunting limits of known aerie sites.

The greatest variety of songbirds occurs in the riparian zone along the Colorado River. Species would be more limited in the pinyon-juniper and saltbush habitat; pinyon jay, honed lark, chipping sparrow, and whitethroated swift would be some of the more common summer residents. Hummingbirds and wrens also are found in the most numbers in the summer months.

Threatened or Endangered Species

Within the DeBeque Canyon area, an active peregrine falcon aerie was discovered in July 1977 (Enderson 1977). The aerie will have to be observed for one or more years to determine whether the falcons will continue to use this nesting cliff or possibly a complex of cliffs in the general area. (See map G2-3.)

Peregrines are apparently able to tolerate a high level of human activity for short durations within 0.25 mile of their nest and a low level of human activity 0.5 to 1 mile from the cliffs they use (Craig 1978, personal communication). The Colorado River and areas adjacent to riparian habitats are suspected to be important hunting areas because of the abundance of peregrine prey in this area. Habitat in this type is being destroyed by changing land use, particularly on-going coal development.

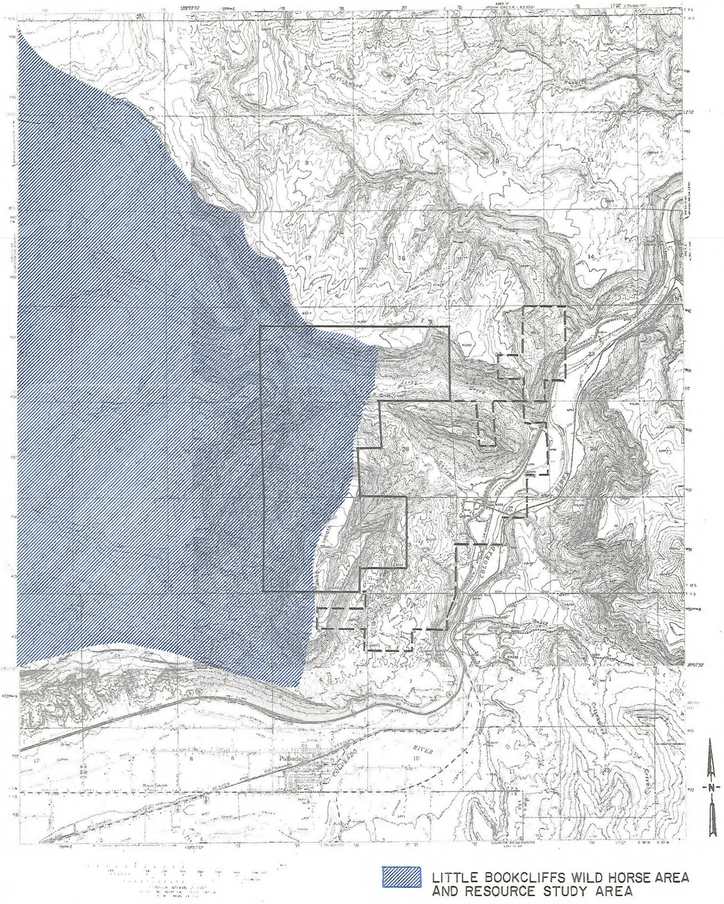
Bald eagles are commonly seen along the Colorado River in DeBeque Canyon throughout the winter months. Birds are frequently observed on hunting forays along the river or perched in cottonwood trees.

Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle.

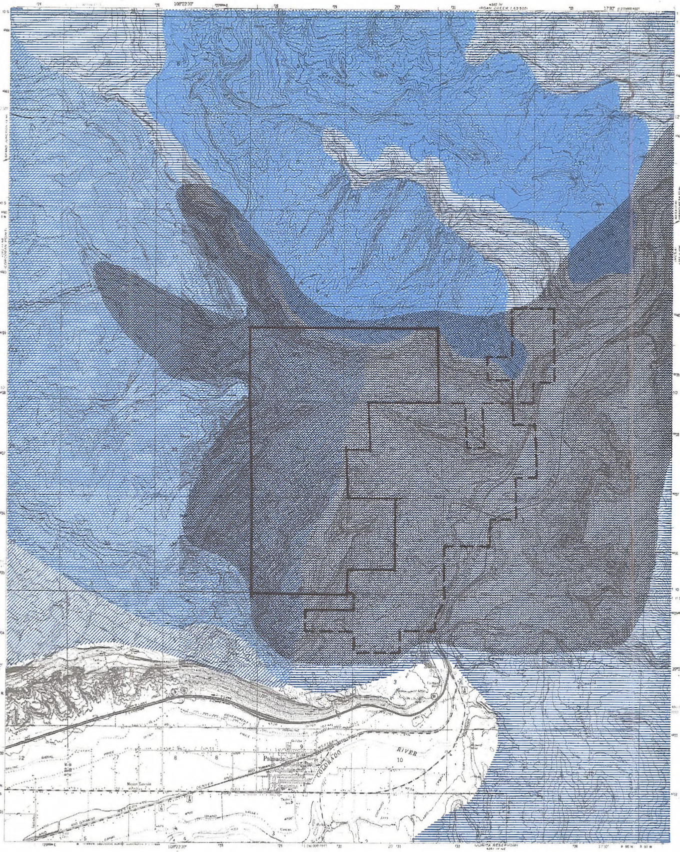
Aquatic Biology

The ephemeral tributaries which flow through the mine site to the Colorado River are Asbury Creek, Coal Creek, Jerry Creek and Rapid Creek. These tributaries are dry washes more than 95 percent of the time. When they do flow, water levels rise and fall rapidly. These dry streams normally flow only as a result of heavy spring snowmelt or severe thunderstorms. Water quality is naturally poor because of the highly erosive drainage. Runoff water is typically very high in sulfates, carbonates, total dissolved solids, and suspended sediments. Aquatic life is not present in any of the tributaries on the Cameo mining site.

The lease site is directly adjacent to the Colorado River and all site drainage enters directly into the river. The Colorado River at this location is considered a warm water fishery. Channel catfish, largemouth bass, sunfish, and bullheads dominate the gamefish population while numerous nongame fish species including roundtail chub, sand shiner, carp, flannelmouth sucker, bullhead sucker, speckled dace, redfin shiner and others are found here.



Map G2-2. Little Bookcliffs Wild Horse Area



ENDANGERED SPECIES
(Peregrine Falcon)

MULE DEER WINTER RANGE

MULE DEER WINTER CRUCIAL RANGE

Map G2-3. Wildlife ranges in the area of the proposed Cameo No. 1 and No. 2 mines: deer, endangered species

Threatened or Endangered Species

From below the confluence of Plateau Creek this section of the Colorado River is habitat for three species of threatened and endangered fish. The Colorado squawfish, the razorback sucker, and the humpback chub are presently known to exist in the river directly adjacent to the mine area. The U.S. Fish and Wildlife Service has recommended this section of river as critical habitat for the Colorado squawfish (see Aquatic Biology, chapter 2, regional analysis).

Cultural Resources

Archeological Resources

A Class III inventory was conducted on approximately 350 acres of the Cameo Mine property (Connor 1975). Although prehistoric use has been noted in the Palisade area, no archeological values were identified within the survey bounds. Sites AR-05-07-615 and AR-05-07-159 are located within the lease area but should remain outside the areas of direct impact.

Historic Resources

In a survey performed in April 1977, no historic sites of significance were discovered in the area. The Government Highline Canal, built in 1912, was noted; however, it would not be affected by the proposed action.

Transportation

Highways

The proposed Cameo mines are located close to Interstate Highway 70. In 1976 average daily traffic on this stretch of interstate was 5,500 vehicles, which is below the capacity of the highway. U.S. Highway 6 diverges from I-70 just west of the mine site and serves much of the inter-city local traffic in the area.

Railroads

The main line of the Denver and Rio Grande Western Railroad lies parallel to I-70 in the vicinity of the Cameo mines. This is the major rail line between Denver and Salt Lake City and serves many of the coal producing areas in Colorado and Utah. Loading facilities are now being built to serve mines in the Cameo area.

Airports

Grand Junction's Walker Field is the major airport in western Colorado and is served daily by Frontier and United Airlines. There is a large amount of room at the airport for expansion.

Livestock

No livestock are grazed in the area of the proposed action due to ongoing mining operations at the Cameo No. 1 Mine.

Recreation

The Cameo lease site contains no recreational facilities; however, it does provide opportunities for dispersed recreation such as hunting and hiking. Species which provide hunting and viewing potential include mule deer, cottontail rabbits, and chukar. Coal Canyon Creek, which runs through the lease site, is an intermittent stream and offers little recreational value. (Refer to Wildlife and Aquatic Biology in this chapter for the extent of these resources.) The lease site is located within Big Game Management Unit 30, which provided 3,364 recreation days in 1976, and Small Game Management Unit 58, which provided 35,723 recreation days in 1975. Tables G2-3 and G2-4 provide recreation days by species. The western portion of the lease site overlaps the Little Bookcliffs Wild Horse Area (see map G2-2), which is also a BLM wildland study area. Management of this area would be subject to the interim guidelines listed in appendix J.

The Colorado Division of Parks and Outdoor Recreation manages the Island Acres Recreation Area, which is located on the Colorado River about 1 mile upstream from General Exploration's proposed coal train loading facility. Island Acres provided opportunities for camping, picnicking, and swimming for 102,578 visitors in 1977.

The majority of the population increase due to mining activity would occur in the Grand Junction-Palisade area. Grand Junction provides city-sponsored leagues for softball, basketball, and volleyball. Facilities in the Grand Junction area include eleven parks, fourteen swimming pools, and sixteen tennis courts. The Grand Junction Recreation Department feels that use of its facilities is now maximum; people have to be turned away from the programs, especially league activities. The department also states that only 40 percent of this use is from city residents, which indicates that the city's programs are a major recreational outlet for the surrounding area. The city of Palisade provides a park with playground, two tennis courts, and a basketball court.

For a comprehensive look at the recreational resources of the region, refer to chapter 2 of the regional analysis, Recreation.

Visual Resources

The Cameo No. 1 and No. 2 Mines would be located in a restricted area surrounded by 1,000 foot cliffs and terraced hills that border the junc-

tion of Coal and DeBeque Canyons. The limited expanse of flat land is bounded by the Colorado River on the east and buff colored rock cliffs on the west. A strong horizontal line is produced in the landscape by the cleavages and rock colors of the cliff faces, which serve as the horizon line for canyon travelers. The Colorado River creates a second linear ingredient which is emphasized by adjacent riparian vegetation, the railroad track, and the I-70 corridor. The landscape is form dominant, because of the lack of vegetative cover, and natural and culturally modified surfaces and volumes are readily apparent in the landscape.

The natural landscape has been modified by numerous developments that dominate the character of the limited viewing area. The large size and brood land coverage of the Cameo Power Plant, the rail alignment and loadout facilities and the I-70 corridor are focal elements in this section of DeBeque Canyon (see figure G2-3) and they establish an industrial landscape character. The extent of these landscape modifications is represented by a VRM Class V (see appendix F for an explanation of the VRM classification process) which denotes a severe modification of the natural landscape.

Socioeconomic Conditions

Demography

Table G2-5 lists the population for each incorporated town and each county census area within Mesa County and western Garfield County, for the 1970 and 1977 censuses. Grand Junction and vicinity is the most heavily populated community between the Denver and Salt Lake City metropolitan areas. As such, it serves as a regional center of commercial and industrial activity for most of western Colorado and eastern Utah. Recent growth in the Grand Junction area has been caused by a variety of economic factors, including the expectation that the area's mineral resources will develop rapidly in the near future. Corporations and government agencies involved in mineral resource development over a wide area have located regional headquarters in Grand Junction. Table G2-5 indicates that most areas around Grand Junction have grown at a moderate rate, averaging between 3 and 5 percent per year since 1970.

The median age of the population in Mesa County is higher, but not significantly higher, than the Colorado median age of 26.2 years. The Palisade area has a relatively older population than the rest of the county, and a much higher concentration of persons over 65 years of age.

The small communities of DeBeque, Collbran, and Grand Valley are similar in size, and all contain a population whose median age is higher than the Colorado median. Collbran is somewhat different from most communities in western Colorado in that the median age of its population increased between 1970 and 1977. The DeBeque and Grand Valley areas have experienced growth due to the location of the Occidental Oil Shale test site outside of DeBeque and the Paraho Oil Shale site east of Grand Valley.

Community Attitudes and Lifestyles

According to the Mesa County Development Department, a majority of the new residents in the Grand Junction area moved there because they liked it as a place to live. The Grand Junction area is more urban than most other areas of western Colorado, but it is still small enough to retain attributes of small town living. Residents place a high value on the casual atmosphere and lack of congestion associated with life in Grand Junction. However, there is also a desire to attract economic growth to the area and improve job opportunities for residents.

As a population center, Grand Junction provides its residents opportunities not available in most other communities in western Colorado. Mesa College offers courses of study in many subject areas, college athletic events, and dramatic performances. There is a larger selection of stores, restaurants, and movie theatres than in other towns. Airline and bus service to metropolitan areas is regularly available, and an interstate highway links Grand Junction to Denver and Salt Lake City.

Community attitudes towards growth and development were documented in a survey conducted by Bickert, Browne, Coddington and Associates, Inc., in July 1973. Results of that survey are discussed in the regional volume.

Community Facilities

Most of the developed areas around Grand Junction receive water from the Ute Water Conservancy District which provides water to other districts and to individuals. The district is currently developing additional water resources. There are many special districts in the county providing various services including water, sewer, fire protection, pest control, hospital services, cemetary services, and flood control. There are two sanitary landfills in the county. Police service outside of town is provided by the county sheriff.

Grand Junction, Fruita, Collbran, Palisade, and DeBeque are improving or plan to improve their water and sewage treatment systems. More detailed information about facilities in the county is included in the regional volume.

Housing

Table G2-6 lists the housing units available in Mesa County and western Garfield County, according to the 1977 special population censuses. The total housing stock in Garfield County in-

TABLE G2-3

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 30

	Deer	Elk	Bear	Mountain Lion	Total
Hunters	854	-	20	9	a/
Recreation days b;	3,122	-	151	91	3,364

Source: Colorado Division of Wildlife, 1976 Colorado Big Game Harvest.

a/ Hunter totals are not provided because hunting and trapping of more than one species are allowed.

b/ All or part of a day.

TABLE G2-4

SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 58

Animal	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	1,166	9,794	Badgers	9	757
Geese	423	1,950	Beavers	17	426
Doves and pigeons	1,106	6,251	Bobcats	30	1,918
Pheasants	2,021	7,203	Ringtailed cats	3	310
Chukars	500	1,123	Coyotes	21	2,086
Grouses	261	814	Foxes	29	1,235
Ptarmigans	7	0	Muskrats	32	1,203
Rabbits	3,952	28,789	Raccoons	20	509
Squirrels	53	225	Skunks	7	144
Foxes	38	72			
Coyotes	386	4,529			
Marmots	98	299			
Prairie dogs	550	4,140			
Magpies	352	5,283			
Total	b/	70,472		b/	8,588

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals are not included because hunting and trapping of more than one species are allowed.

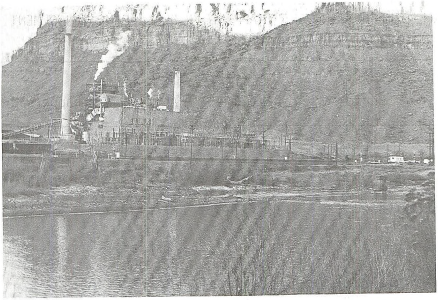


Figure G2-3. The Cameo mine sites are visually influenced by the Cameo Power Plant.

creased by 22 percent between 1970 and 1976. About 40 percent of that increase was mobile homes.

The Colorado Division of Housing (1976) estimates that there was a total of 24,914 housing units in Mesa County in April 1976, an increase of 6,116 units (or 32 percent) from 1970. Over one-third of the total increase in housing stock was mobile home units. In recent years, duplexes and multi-family units have constituted about 30 percent of the new housing starts.

High prices for single-family dwellings and the unavailability of rental units are contributing to an increase in multi-family and mobile home units throughout the county. The county has an above average need for low to moderate income housing, because (1) the median family income is more than $3,000 less than the state median and (2) Mesa County has an above average number of elderly persons.

Education

Education in the areas around the Coal Canyon mine is provided by four public school districts: Mesa County Valley School District 51, DeBeque School District RE49(JT), Plateau Valley School District 50, and Grand Valley School District 16. Mesa County Valley is by far the largest with 96 percent of the combined enrollment. In general, the school districts all have some excess capacity to absorb new students. Mesa County Valley has some problem with capacity of its junior high schools, but plans to expand in the future. Table G2-7 summarizes the situations of the four districts.

Health Care

The level of health care services in and around Grand Junction is the highest in the ES area. The four hospitals located in Grand Junction provide specialized services to much of western Colorado. In addition, the Fruita area is served by a small hospital located in town. There are more physicians located in Grand Junction than in the remainder of the ES area combined. Many of these physicians are specialists, who provide their services to patients from a wide area. Ambulance services to the area are good; both Fruita and Grand Junction operate ambulance services connected with their fire departments. Mental health services are provided to the area by the Colorado West Regional Mental Health Center, which is headquartered at Glenwood Springs but has offices in Grand Junction. The Mesa County Department of Public Health has a staff of six public health nurses who provide generalized health education and preventative health services in addition to specialized activities in tuberculosis control, mental retardation, venereal disease, and handicapped children's programs.

Health care in eastern Mesa County is limited. Collbran supports the Plateau Valley Hospital and Nursing Home. The hospital has six beds, three of which conform to federal standards. The nursing home has thirteen long-term care beds. A single doctor provides most of the service to patients in the Collbran area.

DeBeque and Grand Valley have no health care facilities in town. The nearest doctor for DeBeque residents is in Palisade, 22 miles away, and hospital care is available in Grand Junction. The closest physicians and hospital for Grand Valley residents are in Rifle, about 16 miles away.

Employment

In Mesa County, where most of Cameo's employees would live, employment grew at an annual rate of 6.1 percent between 1973 and 1976. The total number of persons employed increased from 24,030 to 28,622 during this period. As shown in table G2-8 the increase was all in nonagricultural employment; agricultural employment declined by 11.6 percent. A comparison of employment by sector shows that all sectors showed some growth, but the mining, the transportation, the finance, insurance, and real estate, and the contract construction sectors had the largest percentage increases. The increase of 130 percent in mining employment can be attributed to new mining activity in the Uravan uranium belt and coal mining in western Garfield County. Oil shale test projects near DeBeque and Grand Valley have also added to employment in the mining sector. In terms of number of employee, the service trade and mining sectors showed the greatest increase.

Table G2-8 also shows that the trade, service, and government sectors are the largest employers in the Mesa County economy and that, in spite of the fast growth rate, the finance, insurance, and real estate sector and the mining sector are the smallest. The sectors with the largest employment in Garfield County are also trade, services, and government. Almost all sectors have grown since 1970.

The regional volume gives more detail about employment in Mesa and Garfield counties. Employment data for specific towns and cities are not available.

Income

The proposed Cameo Mine property is located in Mesa County, 2.5 miles east of the town of Palisade. According to the U.S. Department of Commerce, Bureau of the Census (1974), 1974 per capita income in Palisade was $4,324. This was substantially below the county average of $4,799, which in turn was lower than the Colorado average of $4,514. Mesa County ranked fourth in the seven-county ES area.

TABLE G2-5

POPULATION STATISTICS

	1970 Population	1977 Population	Percent Change 1970-1977	Median Age-1970 (Years)	Median Age-1977 (Years)	Percent Population Over 65 Years
Mesa County:	54,374	66,848	+ 23	30.2	29.4	+ 11
Clifton area	3,554	5,913	+ 66	30.2	26.8	+ 9
Fruita	1,822	2,328	+ 28	34.1	28.5	+ 15
Fruita area	5,837	7,709	+ 32	29.4	28.4	+ 10
Grand Junction	24,043	25,398	+ 5	32.1	30.2	+ 15
Grand Junction area	28,527	35,871	+ 26	30.0	29.3	+ 13
Orchard Mesa area	6,890	5,012	- 27	28.6	29.6	+ 8
Palisade	874	1,038	+ 19	-	46.9	+ 31
Palisade area	1,964	2,178	+ 10	41.8	38.8	+ 21
Redlands area	4,446	6,826	+ 53	29.9	30.6	+ 6
Whitewater area	605	751	+ 24	36.1	32.6	+ 12
Collbran	225	293	+ 30	-	36.9	+ 20
Collbran area	1,428	1,364	- 4	31.4	33.6	+ 14
DeBeque	155	264	+ 70	-	32.5	+ 14
DeBeque area	306	427	+ 40	42.1	33.5	+ 14
Garfield County:						
Grand Valley	270	377	+ 40	-	30.0	+ 18
Grand Valley area	819	858	+ 5	32.1	30.9	+ 14

Source: U.S. Bureau of the Census, 1970 Population Census and 1977 Special Census for Mesa and Garfield Counties.

TABLE G2-6

EXISTING HOUSING IN PROPOSED ACTION AREA

County	Total Housing Units	
	Occupied	Vacant
Mesa County:		
Collbran	119	13
DeBeque	100	11
Fruita	788	41
Grand Junction	10,129	596
Palisade	418	23
Unincorporated areas	12,321	759
Garfield County:		
Grand Valley	138	19

Source: U. S. Bureau of the Census, Special Population Censuses for Mesa and Garfield counties, 1977.

TABLE G2-7

CHARACTERISTICS OF AFFECTED SCHOOL DISTRICTS

School District	1977 Enrollment	Schools	Design Capacity	Excess Capacity	Teachers	Student: Teacher Ratio	Bonding Capacity (dollars)	Outstanding Debt (dollars)
Mesa County Valley (51)	14,025	30	15,561	1,536	678	20:1	32,043,730	2,500,000
DeBeque (RE49(JT))	160	2	195	35	16	11:1	260,000	130,000
Plateau Valley (50)	284	3	350	66	14	20:1	1,200,000	19,000
Grand Valley (16)	180	1	250	70	17	10:1	800,000	184,000

TABLE G2-8

GROWTH OF EMPLOYMENT BY SECTOR
IN MESA COUNTY, 1973-1976

Sector	1973	1976	Increase	Percent Change
Agriculture	3,030	1,790	- 240	- 11.8
Mining	390	900	+ 510	+ 130.8
Contract Construction	1,330	1,730	+ 400	+ 30.1
Manufacturing	2,280	2,440	+ 160	+ 7.0
Transportation	1,420	1,680	+ 460	+ 32.4
Wholesale and Retail Trade	5,040	5,710	+ 670	+ 13.3
Finance, Insurance, and Real Estate	630	820	+ 190	+ 30.2
Service	3,420	4,410	+ 990	+ 28.9
Government	4,140	4,470	+ 330	+ 8.0

Source: Colorado Division of Employment, Research and Analysis, February 1977.

Note: This information does not include self-employed workers, other than in agriculture, unpaid family, and domestic workers.

Median family income in Mesa County was estimated to be $11,130, third highest in the region but lower than state and national averages. In 1975, 11.4 percent of the families in the county had incomes below the poverty level.

In 1974, government (21.0 percent) and wholesale and retail trade (20.6 percent) were the largest sources of personal income. Other sectors and the share they produced were services, 15.7 percent; Contract construction, 10.2 percent; transportation, communication, and public utilities, 9.9 percent; manufacturing, 8.9 percent; agriculture, 6.9 percent; finance, insurance, and real estate, 3.6 percent; mining, 3.3 percent; and other industries, 0.4 percent. This breakdown indicates the importance of the trade sector in the economy of the county and the role of Grand Junction as a regional center. For a discussion of regional incomes, see the income section in the regional volume.

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describe the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceding sections of chapter 2 which are expected to change in the future: air quality, topography, mineral resources, recreation, and socioeconomic conditions.

Air Quality

At this time, GEX proposes to proceed with mining of private coal from the same proposed facilities on private land. Cameo's operation in 1990 would increase annual average particulate concentrations by 4 micrograms per cubic meter ($\mu g/m^3$) in only a small area on the mine site near the preparation plant and refuse pile; concentrations are predicted to increase by at least 1 $\mu g/m^3$ for a distance of 0.5 to 1 mile from the surface facilities.

With winds from the north, a maximum concentration of 24 $\mu g/m^3$ is projected to occur about 0.5 mile down the canyon. At the mouth of the canyon (2 miles), concentrations on the worst day would be about 3 $\mu g/m^3$. With winds from the south, the maximum concentration is predicted to be 18 $\mu g/m^3$.

The estimated reduction in visual range on the mine site as a result of mining emissions would be less than 2 miles on an annual basis.

Topography

As currently projected, mining at both the Cameo and Roadside properties will have exhausted all coal reserves by 1990. Restoration of approximately the original contour of disturbed areas, as required by 30(CFR): 717.14, will recreate the topography shown on map G1-1.

No estimate is currently available of the acreage of private coal to be mined by 1990. However, whatever its size the entire area overlying the private reserves which are mined will be subject to a maximum of 8 feet of vertical subsidence.

Mineral Resources

By 1990, private coal reserves of the Cameo Mine property will have been exhausted and mining will have stopped. Due to the heavy dependence of the Cameo No. 2 Mine on private coal reserves (as the Cameo No. 2 is currently designed) it is unlikely the Cameo No. 2 Mine would ever have been opened. Instead, all mining will probably have been done through Cameo No. 1.

Recreation

The proposed U.S. Bureau of Reclamation (USBR) Dominguez Dam, just south of Grand Junction (see figure G2-4) would provide water-based recreation such as swimming, fishing, and boating as well as camping and hiking. The USBR estimates that the dam would provide 300,000 to 500,000 recreation days its first year of use. This would help relieve some of the deficit in recreational facilities identified by the 1976 Colorado Comprehensive Outdoor Recreation Plan (see regional analysis, Recreation, chapter 2).

The Little Bookcliffs Wild Horse Area may be classified as a wilderness area. Use of the area would then be restricted to nonmotorized recreational activities.

Socioeconomic Conditions

Population of Mesa County is expected to grow at a rapid rate to 110,700 in 1990. Development of oil shale and uranium and the areas role as a regional center account for the growth. The Grand Junction area will become more urbanized resulting in the continued decline in the importance of agriculture in the local economy. Incomes are expected to be higher.

Garfield County is projected to grow at a rapid rate to 45,238 in 1990 primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale development.

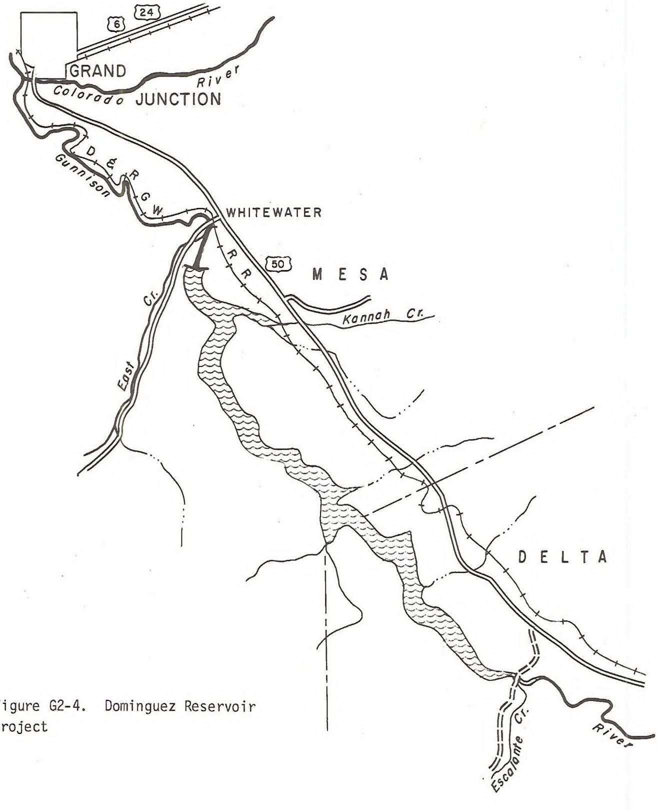


Figure G2-4. Dominguez Reservoir project

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review after promulgation of initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), but it does not fully reflect the requirements of the initial regulations. However, in this environmental statement (ES) the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial. The Department of the Interior will not approve the M&R plan until General Exploration Company (GEX) has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Cameo mine include conveyors, transfer points, train loadout of coal, open storage piles, haul roads for refuse, and wind erosion of refuse piles and other exposed areas at the mine. Some common sources of fugitive dust at underground mines are not projected for the Cameo mine: crushing and sizing should produce negligible emissions because a wet process would be used; haul trucks would not be used to transport coal; and there would be no employee travel on unpaved access roads.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution- producing operation, (2) multiply that activity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Cameo mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division and a recent study of emissions from mining (Colorado APCD 1978, Axetell 1978).

Table G3-A presents estimates of fugitive dust emissions at the Cameo site from each of the identified sources in 1980, 1985, 1990, and 2025 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The estimates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table G3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Cameo site other than fugitive dust sources were exhaust emissions from diesel-powered haul trucks and employees' motor vehicles on mine access roads. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table G3-B. These emissions are based upon rates per mile of travel (emission factors) which will decrease between 1980 and subsequent study years. In the case of Cameo, the reduced emission rates partially offset increased activity rates projected when the mine is at full production in 1990. These emissions

are from both employee travel on the mine site and haul trucks.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the canyon or valley near where mining emissions occur. The site specific meteorological data reflected the prevalence of transport of the pollutants up and down the canyon from the mine. Because of the greater influence of the canyon on maximum concentrations near the mine, a separate model which considers reflection of the plume was used to predict maximum 24-hour concentrations. This short-term model is described in the following section.

The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes. Predicted concentrations are usually accurate within a factor of three.

Since there are no wind data available for the lower DeBeque Canyon area (see chapter 2), the wind and stability data required for the model were obtained by modifying that from Grand Junction airport to reflect orientation of DeBeque Canyon. This wind rose was previously shown in figure G2-A. Emission data were presented in table G3-A.

Predicted increases in ambient concentrations resulting from Cameo's operation in 1990 are shown on map G3-A; map G3-B shows cumulative concentrations from proposed development in the Coal Canyon-DeBeque Canyon area. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 4 micrograms per cubic meter ($\mu g/m^3$) in only a small area on the mine site near the preparation plant and refuse pile; concentrations are predicted to increase by at least 1 $\mu g/m^3$ for a distance of 0.5 to 1 mile from the surface facilities. Predicted impacts in 1980 and 1985 are slightly lower but are shown to occur in these same areas. Based on these concentrations, it is not anticipated that the emissions would cause significant increases in annual average concentrations outside the canyon area.

The predicted impact of the mine is much less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. It is also much less than the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD) although coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

The dispersion model used to predict maximum 24-hour particulate concentrations assumed Gaussian distribution of particulates away from the plume centerline, a constant wind direction, and complete reflection of the plume off both canyon walls. The basic dispersion equation is described in detail in *Workbook of Atmospheric Dispersion Estimates* (Turner 1970). The fallout function was not incorporated in the short-term model.

Several locations (receptors) up and down DeBeque Canyon from Cameo were specified in the model for prediction of ground-level concentrations. At each receptor, the contribution caused by each emission source at Cameo was calculated separately; individual source contributions were summed to determine the total concentration at the receptor resulting from the mining operations.

Wind data from the Mt. Logan-Mt. Callahan reach of DeBeque Canyon (see chapter 2) indicated that winds blew from the south-southwest, or up canyon, for all 24 hours on five different days in one year and from the north-northeast, or down canyon, on two entire days. These time periods were assumed to produce the highest concentrations since downwind receptors would be in the plume continuously. From these 24-hour periods, the two days (one with south winds and one with north winds) with the lowest average wind speeds and most stable atmospheric conditions provided the meteorological input for modeling.

The annual average emission rates from the CDM model were also used to predict maximum concentrations because no information was available on seasonal variations in production. Although it is expected that emission rates will vary somewhat throughout the year, the sources at Cameo mine are not subject to great increases in emissions due to equipment malfunction or high wind speeds. Also, increased emissions at different sources

would occur independently rather than simultaneously and would probably not occur at the same time as the most adverse meteorological conditions.

Predicted maximum concentrations from the mine in 1990 are shown on map G3-C. With winds from the north, a maximum concentration of 24 $\mu g/m^3$ is projected to occur about 0.5 mile down the canyon. At the mouth of the canyon (2 miles), concentrations on the worst day would be about 3 $\mu g/m^3$. With winds from the south, the maximum concentration is predicted to be 18 $\mu g/m^3$. These concentrations are considerably less than the 24-hour primary air quality standard of 260 $\mu g/m^3$ and the secondary standard of 150 $\mu g/m^3$, and they are projected to occur only in the immediate vicinity of the mine. Maximum concentrations in 1980 and 1985 would be 20 and 23 $\mu g/m^3$, respectively.

Because the short-term dispersion model involves prediction of extreme conditions for meteorology and emission rates, it is probably slightly less accurate than the annual model.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine will reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west-central Colorado has been empirically determined by Ettinger and Royer (1972); it is shown in figure G3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due to precipitation. Therefore, the equation is more likely to predict visual range over an averaging period of a year than for a short-term period such as 24 hours.

As indicated on map G3-A, particulate concentrations in 1990 would be increased to a distance of 0.5 to 1 mile from the surface facilities. Along any line of sight from the main mine buildings, concentrations would be increased an average of about 2.5 $\mu g/m^3$ over this limited distance. Using the equation above and a background particulate concentration of 42 $\mu g/m^3$, the estimated reduction in visual range on the mine site as a result of mining emissions would be less than 2 miles on an annual basis. Because of the limited area of air quality impact, average visibility would not be affected significantly off-site. Visibility reductions in 1980 and 1985 would be even less than in 1990.

Geologic and Geographic Setting

Topography

Impacts to the topography of the Cameo mine property which would result from the proposed action would be minimal. GEX has already begun construction of surface facilities needed so that mining on the private coal leases can begin. The two aspects of the proposed federal action that would produce impacts are the long-term use of the refuse disposal area and subsidence.

Use of the refuse disposal area for the 47-year mine life would gradually alter the surface topography of the 51-acre area. The 51 acres represents approximately 1 percent of the total project acreage. Natural slopes at the site vary from 9 percent to 40 percent (or 5 degrees to 21 degrees) and local relief is approximately 270 feet. Final slope would be 7 percent. No details concerning the amount of refuse to be deposited at the site were provided by GEX.

A more significant impact of the proposed mining operation would be the surface subsidence of approximately 2,560 acres (100 percent of the federal lease) of the mine property. There are currently no models which predict the surface subsidence produced when conventional room-and-pillar mining methods, such as GEX proposes, are used. However, surface subsidence cannot exceed a maximum of 8 vertical feet, the height of the coal seam which will be mined. Subsidence from conventional mining methods may be incomplete for decades after mining, and surface collapse may be sudden, irregular, and unpredictable. Open fractures, broken ground, and a hummocky terrain may result.

In the discussion of surface subsidence in the Cameo mine plan, GEX cites a long history (exceeding 70 years) of coal mining in the Palisade area with no evidence of surface subsidence to date. The presence of a massive, competent sandstone member 35 to 40 feet above the Cameo B seam may prevent subsidence from migrating to the surface (Skidmore, mining engineer, GEX, 1978, oral communication). This observation is particularly important because the subsidence characteristics of one area of a coal field seem to remain uniform throughout the coal field (Morgan, Bureau of Mines, 1978, oral communication). At this time it would appear that the 8 feet maximum vertical subsidence, open fractures, and broken surface discussed above, constitute a worst case possibility that could result from the proposed action. The impact to result from the mining operation may vary from no subsidence to a maximum of 8 feet of subsidence.

TABLE G3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED CAMEO MINE SITE

Emission source	Emissions, ton/yr 1980	1985	1990 & EML
Conveyor - 4 sections	5.0	6.2	7.5
Transfer points - 4 points	15.0	18.7	22.5
Preparation plant - wet process	neg	neg	neg
Train loadout	0.1	0.1	0.1
Open storage - raw coal	10.1	10.1	10.1
- surge pile	1.5	1.4	1.4
Haul roads (refuse only)	13.5	17.0	33.9
Access roads	0.5	0.5	0.5
Exposed areas - refuse	4.0	4.0	4.0
- rail/mine facilities	2.0	2.1	2.1
TOTAL	51.7	60.1	82.1

TABLE G3-A

EMISSIONS OF GASEOUS POLLUTANTS FROM THE PROPOSED CAMEO MINE SITE

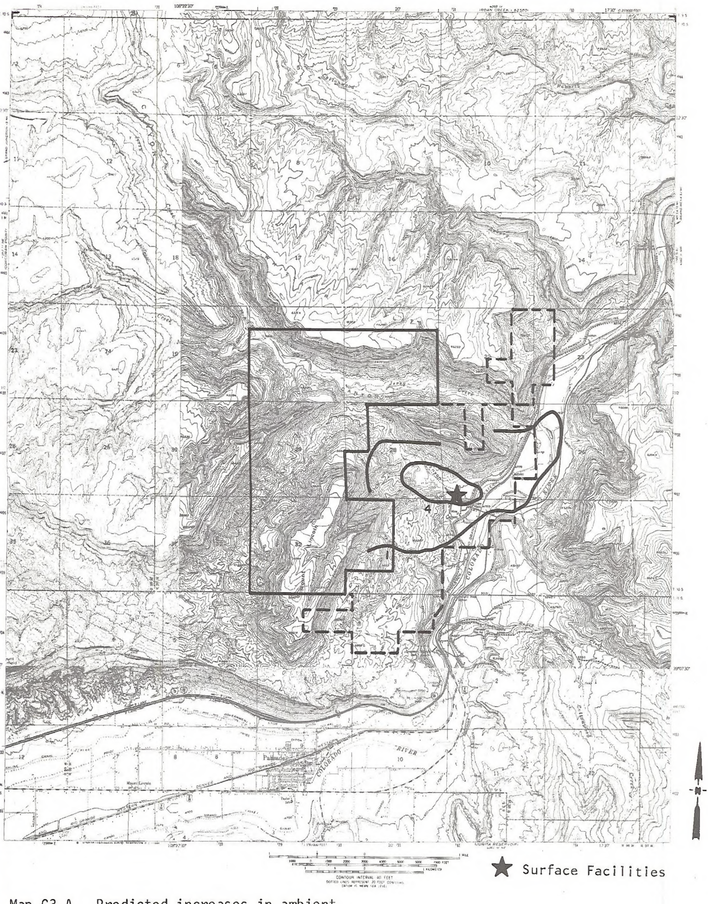
Year	Total emissions from vehicles, ton/yr CO	HC	NO_x	SO_x
1980	0.4	0.1	0.2	neg
1985	0.5	neg	0.2	0.1
1990	0.6	0.1	0.2	0.1

$$L_v = \frac{24}{0.2 + 0.007\ M}\text{, where}$$

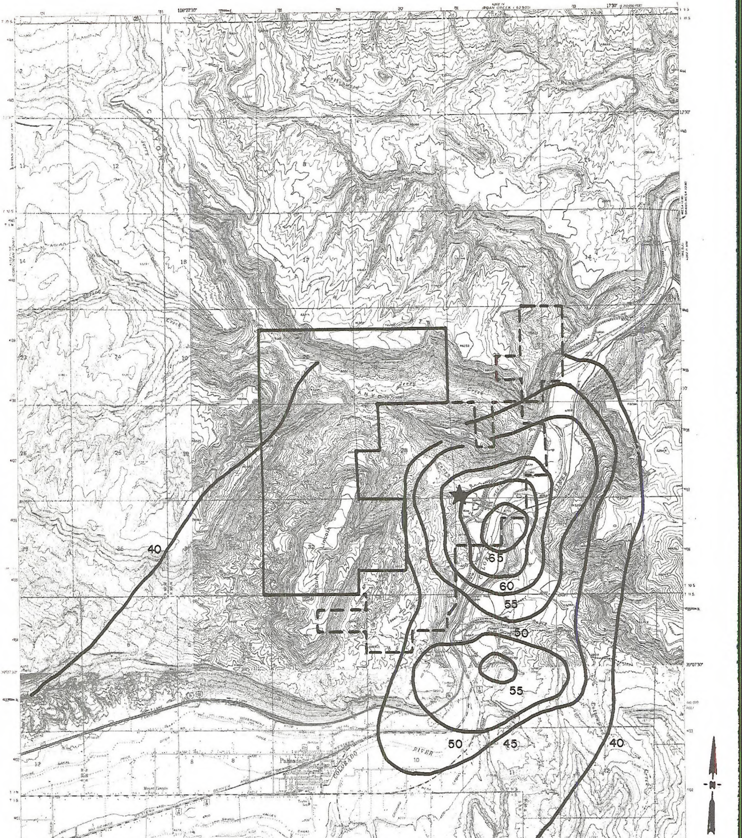
L_v = Average visual range, miles

M = Average particulate concentration (micrograms per cubic meter)

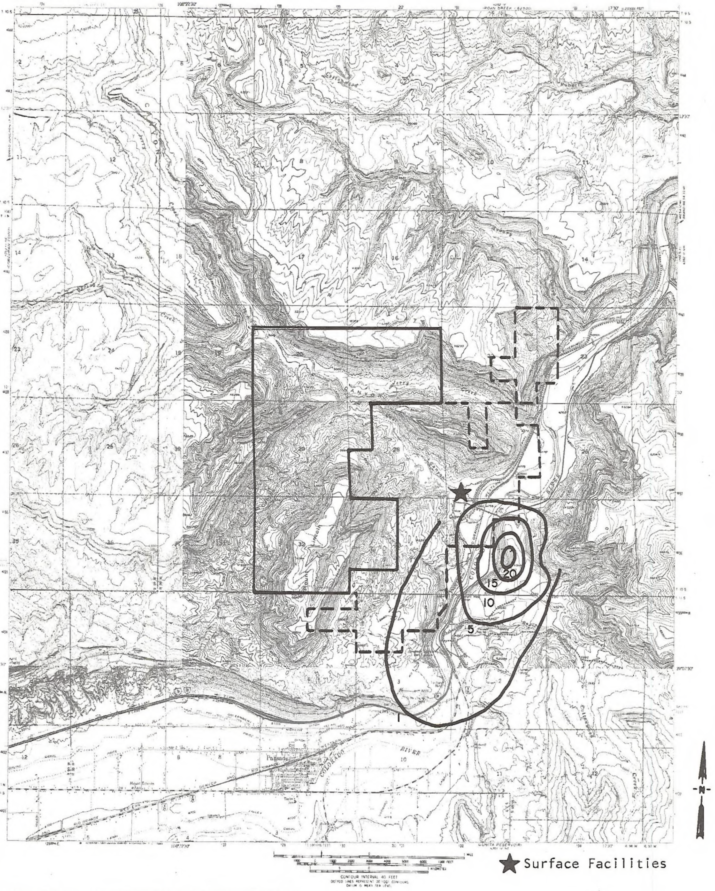
Figure G3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).



Map G3-A. Predicted increases in ambient concentrations in 1990 (micrograms per cubic meter)



Map G3-B. Cumulative concentrations from proposed actions in the Coal Canyon-DeBeque Canyon area (micrograms per cubic meter)



Map G3-C. Predicted maximum 24-hour concentrations in 1990 (micrograms per cubic meter)

If subsidence did occur, increased air circulation through deep fractures may cause spontaneous combustion of the coal seam. A potential loss of the coal resource, in addition to further subsidence, would occur.

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased vandalism and unauthorized fossil collecting as a result of increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above disturbance, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the Bureau of Land Management (BLM)-U.S. Geological Survey (USGS) memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

Coal

The mining of an estimated 22.91 million tons of coal from the proposed project area over an estimated 47-year mine-life period would result in the depletion of a nonrenewable energy source. The coal would constitute approximately 2.1 percent of the total coal reserves over 42 inches in thickness in the Mesa County portion of the Colorado section of the Bookcliffs coal field. The mined coal is expected to be exported to midwestern utility plants for use in the production of electrical energy.

The underground mining of the coal by the proposed room-and-pillar method would result in the recovery of approximately 50 percent of the coal reserves. This is the most efficient method of mining the leased coal. Because of the nature of underground caving and resultant high contamination, future recovery of the abandoned approximately 50 percent of the coal reserves is not considered feasible with present technology and, therefore, must be considered as lost.

Oil and Gas

If oil and gas are discovered under the leased land, a settlement between the well owners and owners of the coal lease would have to be reached as to which nonrenewable energy resource would be produced first.

Water Resources

Surface Water

Because of the arid environment of the lease area and the relatively small area of disturbance there would be no significant impact to the surface water resources. However, because of the lack of specific locations and engineering design of diversion channels and water control structures, impacts cannot be properly assessed until these facilities are designed. Assuming that the facilities are properly located and designed according to regulations in 30(CFR): 717, then there would be no significant impacts on the surface waters of the site or on the nearby Colorado River.

The increase in population in the Palisade-Grand Junction area due to the Cameo No. 1 and No. 2 mines will cause an increased consumption from the municipal water supplies of these communities. Based on projected population increases generated in the socioeconomic section of chapter 3, increased municipal water consumption will be 46 acre-feet per year in 1980, 617 acre-feet per year in 1985, and 780 acre-feet per year in 1990.

Ground Water

The impact of ground water removal from the mine workings is insignificant on a regional basis. The quantity of ground water that can be expected from the mine is unknown, so the impacts on a local basis cannot be predicted. However, from this mine alone, the impacts are probably insignificant to the ground water supply.

Water Quality

The proposed refuse disposal location is within the mouth of a natural water course with a drainage area of 0.8 square mile. The design of the drainage system for this disposal pile has not been given so the impacts of flash flooding on the refuse area cannot be evaluated. A 10-year/6-hour storm event with a precipitation rate of 1.3 inches per hour, and a 25-year/6-hour storm event with a precipitation rate of 1.5 inches per hour, will produce peak flow rates through this proposed refuse area of 460 cubic feet per second (cfs) and 575 cfs, respectively. The failure to control runoff flow

rates of these magnitudes through the disposal area will cause short term, but significant increases in suspended sediment and degradation of the water quality of the Colorado River. Assuming that a drainage system is properly designed according to 30(CFR): 717, then there would be no impacts from storms equal to or less than a 10-year/24-hour precipitation event.

There would also be an unquantifiable reduction in water quality of the Colorado River due to increases in municipal wastes from population increases associated with the proposed action. This impact would be insignificant when compared with impacts from expected cumulative regional growth.

Soils

Soil impacts would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban area expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 8 feet (see Topography). Soil impacts would be minimal where no breaks occurred in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

Construction activities and associated disturbances due tô surface facilities would be confined to approximately 164 acres already disturbed (includes approximately 90 acres of cropland) and an additional 69 acres by 1980. The total of 233 acres would remain unchanged through 1990. Erosion would increase perhaps two to three times the natural rate in response to this disturbance. Within the design limitations of the proposed action, most of this erosion would be contained on-site by drainage systems and other sediment control measures. However, these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology). Over the 47-year mine-life, there is a 99 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration of soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable at present, would further complicate the inherent revegetation problems of low natural moisture and poor topsoil. These problems would prolong the efforts necessary to achieve successful reclamation (see Vegetation).

Off-site disturbances due to mine-related population increases would amount to 10 acres by 1980, 134 acres by 1985, and 169 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come from croplands in Mesa County. To this extent, crop production capacity would be permanently lost. Soil erosion could initially increase from two to three times the natural rate, than gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

The bulk of GEX's mining operations will be on 164 acres of land that is currently disturbed by the company's mining of private coal. An additional 69 acres of disturbance would occur as a result of the proposed action, beginning by 1980 and continuing through the mine life, due to a refuse pile, the Cameo No. 2 portal, and a test site. This disturbance would be largely in the saltbush type, although scattered stands of sage and isolated junipers are also present. The impacts of the disturbance would be to reduce the visual aesthetics of the area, increase soil erosion, and reduce the numbers of wildlife and livestock in the area (discussed in the appropriate sections).

Cameo would be required to revegetate the 233 acres of existing and additional disturbance at their mine site upon abandonment of the mine. Specific revegetation measures that would be required by the federal coal mining regulaions are stated in 30(CFR): 717.20, and 30(CFR): 211.40, 211.41, and 211.62 in the Federal Register (Vol. 42, No. 239, and Vol. 41, No. 96). These regulations cover the operator's (Cameo's) responsibility and length of liability for revegetation; 30(CFR): 211.40(a)(13)(i) state that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vegetation, shall be established on regraded and other affected lands.'

Problems may be encountered in attempting to revegetate the disturbed areas (such as steep south-facing slopes, low annual precipitation, high soil salinity, weed infestation) which may prolong the period of time required for successful revegetation. In such cases a five year extension of Cameo's responsibility for revegetation efforts may be necessary, beyond the 5 year period initially established by the Government authorizing office responsible for monitoring revegetation at the Cameo mine site, discussed in 30(CFR): 211.40(a)(13)(ii).

Urban expansion caused by population increase related to coal mining would result in the disturbance of an estimated 10 acres of vegetation by 1980, 134 acres by 1985, and 169 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers. This is discussed further under soils.

Increased numbers of people in the area would result in additional disturbance of native vegeta-

tion, particularly by off-road-vehicle use. This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Wildlife

Mule Deer

Approximately 164 acres of habitat have been destroyed, and an additional 69 acres would be destroyed by 1980 and for the life of the mine. The total 233 acres would have supported 43 deer, based on 29.8 deer days per acre. The area of active use by GEX is not considered to be crucial mule deer winter range. Disturbance of the animal has already began with the clearing of vegetation from the portal area and the riparian zone for the loadout facilities. Further exploration or road development to the north would cause an additional disturbance and stress on the mule deer utilizing this area in the winter. Animal vehicle collisions would increase due to increased vehicular traffic.

It is difficult to predict to what extent subsidence would affect mule deer because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Secondarily, individual animals could be frightened by humans in the area (mine workers, sightseers, etc.) and driven into the subsidence area where they could be injured or killed by the sharp changes in topography. To some extent, however, mule deer would gradually develop trails through the areas which would lessen the danger for them.

Wild Horses

It is not anticipated that this operation would impact the wild horses unless development is done further up canyon from the present and proposed facilities.

Small Mammals

The impact to these species have already occured. Namely destruction of habitat for portal loadout facilities, loss of small, immobile mammals and reptiles and loss of dens and burrows.

Game Birds

Some waterfowl nestings and brood rearings in the vicinity of the loadout could be disrupted and even eliminated by the human activity close to the river. Activities could impede movement of chukars to watering areas near the Highline Canal.

Secondary Impacts

Secondary impacts from the proposed action would include increased human population resulting in expansion of urban areas onto agricultural land and some crucial winter range; increased vehicular traffic resulting in an increase in vehicle/animal collisions; and increased recreational use of the area causing an additional stress on the animals and increasing legal and illegal harvest of animals. This illegal kill could increase 10 times or 1,000 percent over current estimates (Al Whitaker, 1978, personal communication).

Threatened and Endangered Species

Two species could be affected by the development of this lease, the peregrine falcon and the bald eagle. Hunting areas in the riparian zone for both species have been eliminated by the clearing of vegetation along the river. A more serious impact could be disturbance of nesting peregrine falcons. Disturbances around nests have caused the birds to abandon the nest site in other areas and this could occur at the nest in DeBeque Canyon due to increased human activity near cliffs.

Aquatic Biology

Cameo plans to discharge 576,000 gallons per day (gpd) early in the mine life and to increase this to a maximum discharge 1,440,000 gpd at full production. These values are equivalent to 0.88 cfs and 2.31 cfs, respectively. The discharge would be to Coal Creek, approximately 1,000 feet from the Colorado River. A NPDES system permit has been applied for from the Colorado Water Quality Control Division. The mining plan states that if water quality becomes so bad that it cannot be discharged to Coal Creek, then it will be passed through the plants water clarification system. A sewage treatment facility would be installed on the site, and a discharge permit would be obtained for any effluent released to Coal Creek. There would be two discharge points on Coal Creek. If these discharges are of poor physical or chemical quality, downstream aquatic habitat in the Colorado River could be degraded.

Sediment retention facilities and a refuse disposal pile also pose a potential threat to aquatic life in the Colorado River. Proper location and construction of these facilities as mandated in the surface mining regulations should assure that failure or washout will not occur during a flood.

Endangered or Threatened Species

If the nearby section of the Colorado River receives designation as critical habitat for the Colorado squaw fish by the Secretary of the Interior, then any action taken on a federal coal lease which would diminish the value of the river as aquatic habitat would be in direct conflict with Section 7 of the Endangered Species Act of 1973. In no case

would any change in the water chemistry of the Colorado River be consistent with federal law.

Failure of one of the sediment retention structures could release materials into surface drainages which could cause the extinction of several threatened and endangered fish species in the adjacent Colorado River.

Cultural Resources

Archeological Resources

The lack of identified archeological values within proposed activity areas of Coal Gulch and Coal Canyon (Connor 1975) suggest there should be no impacts to archeological resources within the surveyed area. Approximately 164 of the 233 acres at the proposed Cameo site which would undergo dirt-moving procedures have already been disturbed. With the natural integrity of these areas destroyed, furthur impacts to archeological values should be minimal. However subsidence, as it could result in surface disturbance of 2,560 acres of the mine property, could displace or damage any existing archeological sites in the areas of impact.

Prior to approval of the proposed action, a concurrence of approval could be developed by the BLM with GEX to provide for the protection of cultural values from the effects of subsidence. This could include provisions for work stoppage and compliance with Section 106 (National Historic Preservation Act, amended 1976), should archeological values be uncovered during mining and construction activities. In addition, should areas of surface subsidence be identified, provisions for a Class III survey in the impact areas should be arranged in order to minimize the potential damage to archeological sites.

Historic Resources

Since there are no known historic sites in the study area there would be no direct impacts due to mining. Should sites be found in the course of mining activity, they would be reported to the Area Mining Supervisor and at that time those sites would be evaluated and protected under the Historic Preservation Act according to procedures outlined in 36(CFR): 800.

Transportation

Highways

Development of the Cameo mines would result in increased traffic on U.S. Highway 6 and I-70. Traffic could increase by as much as 266 vehicles, or 532 round trips, per day. This would be an 11 percent increase in traffic. Although the freeway has excess capacity to handle the traffic some increase in accidents could be expected. Increased congestion, especially at shift changes, would slow traffic on the route.

Railroads

Coal produced at the Cameo mines would be loaded onto unit trains at a loading facility now being constructed near the mines. At peak production from two to three unit trains per week would be required to move the coal. This would increase congestion on the D&RGW main line and through major cities in Eastern Colorado where coal from other producing areas in the west must also pass.

Airports

Some increase in passenger traffic at Walker Field would result from the greater population in the area.

Livestock

It is very likely that some of the acreage disturbance resulting from urban expansion due to increased population (10 acres in 1980, 134 acres in 1985, and 169 acres in 1990) would be on irrigated and nonirrigated hayland and pasture. This would adversely impact the livestock industry because these lands are used as livestock wintering areas, and the hay harvested from them in the summer is used to feed the livestock during winter.

Recreation

The influx of additional population due to the Cameo mining operation and the subsequently increased demand for recreational opportunities could have an impact on existing recreational resources and facilities, particularly community facilities, in the Grand Junction-Palisade area. Since Grand Junction's recreational facilities are now fully utilized (Grand Junction Recreation Department 1977), increased use would result in overuse, which would lead to their deterioration and lower their capacity to provide enjoyable recreation. The community facilities needed to meet the increased demand and prevent overuse are projected in table G3-1, which shows a need for 4.6 acres of active/improved park land by 1985 and 5.8 acres by 1990. Capital investment to provide the facilities is also projected in table G3-1.

The increased demand for dispersed recreational opportunities (e.g. hunting, hiking, ORV use) should not adversely affect the recreational resource; however, concentrated use, such as an ORV rally, could lead to vegetative deterioration and a lower quality recreation experience on that site. Increased use of recreation facilities (such as Island Acres Recreation Area) would lead to increased maintenance cost for the managing agencies. The extent of the increased use and costs are not known.

TABLE G3-1

GEX - CAMEO
ADDITIONAL COMMUNITY REREATION FACILITIES DEMAND

	1980	1985	1990
Population Growth	-	1,380	1,770
Active/Improved Parks a/	-	4.6 acres	5.8 acres
3.3 acres per 1,000 residents capital investment			
66,666 per 1,000 residents	-	$91,999	$117,999

Source: Bickert, Browne, Coddinton & Associates, Inc., 1976.

a/ e.g. Ballfields, tennis courts, playgrounds.

The increased use of recreational facilities could be offset by providing additional facilities. The Heritage Conservation Recreation Service, through the Land and Water Conservation Fund Act (PL 88-578), could provide monies for this purpose if matching funds are provided by the local agency. The mineral leasing funds (Colo. S.B. No. 35, Section 2, 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreational facilities under the Recreation and Public Purposes Act, 43(CFR): 2740, which allows nonprofit associations to acquire lands for recreational purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior; therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The Cameo mining operation is not expected to impact the wilderness values of the Little Bookcliffs Wild Horse Area as mining on this portion of the lease would be underground with no surface facilities planned.

Visual Resources

The influence of Cameo No. 1 and No. 2 mines on the landscape character would be minimal because of the extent of existing surface disturbance. Little visual contrast (see appendix F for contrast tabulations) would result from the addition of further modifications within this landscape. The Cameo Power Plant and associated facilities would continue to dominate the landscape character.

Socioeconomics

Demography

In calculating the population growth associated with the Cameo No. 1 mine, it was assumed that 80 percent of the new employees would reside in Mesa County and 20 percent would reside in Garfield County. As a result of the Cameo mines, there would be an increase in total population of 1,070 persons by 1985 and 1,430 persons by 1990 in Mesa County. In Garfield County the increase in population due to the Cameo No. 1 mine is estimated to be 310 persons by 1985, and 340 persons by 1990. The distribution of this population would parallel the distri bution of population associated with the Coal Canyon and Cottonwood Creek mines, a discussion of which is contained in the Coal Canyon and Cottonwood Creek site specific analyses.

The combined development of the Coal Canyon, Cottonwood Creek, and Cameo mines may have a pronouned effect upon the small community of Palisade. Palisade has remained a stable, agricultural community with a relatively high concentration of older persons for some time. A rapid influx of new population would certainly threaten the present character and social structure of the community. It would also place a burden on the elderly residents as the cost of living rises due to the demand for increased local government services. General changes expected in attitude and lifestyle due to increased coal mining in the area are discussed in the regional volume.

Community Facilities and Services

The projected minimum community facility requirements for Mesa and Garfield counties associated with the Cameo No. 1 mines are listed in table G3-2. These figures were derived in a similar manner to those con tained in the regional volume in table R4-19.

Table G3-2 does not reflect the major capital expenditures which are now being made in many communities in both Mesa and Garfield counties. These cost figures represent needed capital requirements over and above any facilities which exist or which are under development.

Increases in the local property and sales tax revenues attributed to the Cameo development are listed in table G3-3. These revenues represent the total property and sales tax revenues expected to flow to all local government entities. Since the estimated increases in com munity facility expenditures would be born by county, municipal, or special district units of local government, it is necessary to subtract out the school district share of the revenues in order to make a com parison. If this is done, it decreases the locally derived revenues available for county, municipal and special district purposes in Mesa County to an estimated $681,700 in 1985 and $774,900 in 1990. Comparing these revenues with the yearly operating expenses and amortized (assumes debt financing over twenty years at 6 percent interest) capital expenses of $220,800 per year shows that Mesa County should experience a revenue surplus form the Cameo No. 1 Mine, starting soon after the mine is operational.

Locally derived revenues available for county, municipal and special district purposes in Garfield County are estimated to be $83,900 in 1985 and $95,000 in 1990. Comparing these revenues with the yearly operating and amortized capital expense of $51,300 per year shows that Garfield County should experience a revenue deficit through 1990.

Housing

The projected demand for new housing in Mesa and Garfield counties as a result of population growth attributed to the Cameo mines is listed in table G3-4. The same assumptions regarding housing mix and family size that were used in the regional analysis were used in these calculations.

The new housing requirements associated with the Cameo mines represent about 4 percent of the total projected new housing require ments in Mesa County by 1990, and about 1 percent of the projected new housing requirements in Garfield County by 1990. This housing and its related roadway requirements should use about 122 acres of land in Mesa County and 47 acres of land in Garfield County.

Schools

The expected increase in school-aged population due to the development of the Cameo mines is shown in table G3-5, and the increase in school district capital requirements and operating costs anticipated from that population increase are shown in table G3-6.

Most of the increase in school-aged population within Mesa County due to the Cameo mines development would occur within School District 51. Since the mine itself is also located within the jurisdictional boundaries of School District 51, that district would receive an additional 20.8 million in assessed valuation from the facility itself by 1985 and 21.3 million in 1990. That increase in assessed valuation would allow the district to increase its bonded indebtedness by 4.2 million, which is in excess of the projected capital facility requirements. School District 49(JT) in DeBeque would also be required to provide for some of the increase in Mesa County school-aged population associated with Cameo No. 1. Even though District 49(JT) would not benefit from any of the increase in property tax base from the Coal Canyon Mine, the tax base increase it is expected to receive from the Sheridan Mine would be more than sufficient to meet its capital requirements. The increases in school operating costs projected for Mesa County as a result of the Cameo No. 1 development would be met by increased school district revenues without an increase in tax rates.

In Garfield County, the increases in school-aged population from Cameo No. 1 should occur in the Grand Valley District 16 and the Garfield District RE-2. The total expected increase in property tax base in Garfield County from new population associated with the Cameo mines would be 1.3 in 1995, and 1.5 million in 1990. That increase would allow the Garfield County school districts to raise their bonded debt by $278,000 or far double estimated requirement for school capital facility needs.

Health Care

Population growth associated with the Cameo No. 1 Mine is expected to increase the demand for health care facilities in the Grand Junction area and the Rifle area. Due to their proximity to the Grand Junction area, neither the Cameo No. 1 Mine nor its two neighbors, the Cottonwood Creek and Coal Canyon mines, are likely to have significant adverse effects on the area's health care facilities individually. However, since population growth as a result of these three operations would affect the same area, the cumulative effect on health care service delivery is important. There would most likely be a need for expanded health care services in the town of Palisade, especially emergency services, to serve all three operations. Table G3-7 is an estimate of the capital facilities needed in Mesa and Garfield counties to meet the projected increase in demand for health care services from all three mines in the Cameo area. Most of the existing health care facilities in the area are supported by fees collected for services performed instead of through local tax revenue.

Employment

Development of the Cameo mines would affect employment in Mesa and Garfield counties. In 1980 mine employment would be 426 persons, which would cause an increase in total employment of 860 persons in Mesa Count and 380 persons in Garfield County. In 1985 mine employment would be 375 persons and total employment would be 757 persons in Mesa County, and 337 persons in Garfield County. In 1990 399 persons would be employed at the mine causing a total employment change of 806 persons in Mesa County and 359 persons in Garfield County. These are increases of 3 percent of the total employment in Mesa County in 1977, and between 4 and 5 percent in Garfield County.

Income

The eventual employment of 400 people at the Cameo mine would have a significant impact on income in Mesa County. Because no information was given by GEX about expected payroll, an average income of $16,600 per employee is assumed for analysis. Average income at the mine would be considerably higher that Mesa County's 1975 median family income of $11,130. Mine employment, payroll, and the total change in regional income due to the Cameo mines are shown in table G3-8.

TABLE G3-2

ADDITIONAL REQUIREMENTS FOR COMMUNITY FACILITIES CAMEO # 1

	Wat Treatm		Police Protection	Fire Protection	Streets and Roads	General Government	Libraries	Total
Mesa County:								
Physical Plant Requirements (1990)	.5MGD	.14MGD	570 S.F. of space 1 vehicle	1430 S.F. of space .5 vehicle	43 acres	360 S.F. of space	800 S.F. of space 4,300 volumes	
Capital Costs (1990)	$438,000	$472,000	$46,200	$94,700	$1,400,000	23,200	$59,000	$2,533,000
Operating Costs								
1980	0	0	0		0		-	0
1985	$23,500/year	$17,200/year	$40,000/year	$18,000/year	$31,200/year	$36,000/year	-	$166,000/year
1990	$31,400/year	$23,000/year	$60,000/year	$18,000/year	$41,800/year	$54,000/year	-	$228,000/year
Garfield County:								
Physical Plant Requirements (1990)	.12 MGD	.03MGD	150 S.F. of space	340 S.F. of space	10 acres	85 S.F. of space	200 S.F. of space 1,000 volumes	
Capital Costs (1990)	$104,000	$112,000	$10,000	$13,600	$329,000	$5,500	$14,500	$588,600
Operating Costs								
1980	0	0	0	volunteer	0	0	-	
1985	$6,800/year	$5,000/year	$20,000/year	-	$9,000/year	$18,000/year	-	$58,800/year
1990	$7,500/year	$5,500/year	$20,000/year	-	$9,900/year	$18,000/year	-	$60,900/year

TABLE G3-3

INCREASED REVENUE TO GARFIELD AND MESA COUNTIES FROM THE CAMEO MINES

	1980	1985	1990
Garfield County			
Property Tax			
Homes	-	$ 81,000	$ 91,820
Businesses	-	25,670	29,100
Sales Tax	-	49,620	56,240
Service Fees	-	13,560	15,320
Total	-	$ 169,850	$ 192,480
Mesa County			
Property Tax			
Mines	$132,110	$1,368,560	$1,401,590
Homes	-	273,170	372,180
Businesses	-	58,840	78,640
Sales Tax	-	133,320	178,080
Service Fees	-	25,280	33,770
Total	$132,110	$1,859,170	$2,064,260

TABLE G3-4

NEW HOUSING REQUIREMENTS - CAMEO #1

	Single-Family Units	Mobile Homes	Multi-family Units	Total Units
Mesa County				
1980	0	0	0	0
1985	232	89	36	357
1990	310	119	48	477
Garfield County				
1980	0	0	0	0
1985	67	26	10	103
1990	74	28	11	113

TABLE G3-5

INCREASE IN SCHOOL AGE POPULATION CAMEO #1

	1980	1985	1990
Mesa County	0	280	300
Garfield County	0	80	90

TABLE G3-6

SCHOOL DISTRICT FACILITY REQUIREMENTS

	1980	1985	1990
Mesa County:			
Facility Requirements	0	39,200 S.F.	42,000 S.F.
Facility Costs	0	$1,764,000	$1,890,000
Operating and Maintenance Costs	0	$344,400/year	$369,000/year
Garfield County:			
Facility Requirements	0	11,200 S.F.	12,600 S.F.
Facility Costs	0	$504,000	$567,000
Operating and Maintenance Costs	0	$98,000/year	$110,700/year

TABLE G3-7

COAL CANYON, COTTONWOOD CREEK, CAMEO NO. 1:
PROJECTED HEALTH CARE FACILITY REQUIREMENTS

County and Year	Facility Requirements	Facility Costs (dollars)
Mesa:		
1980	1 hospital bed	55,000
1985	9 hospital beds and 1 emergency vehicle	510,000
1990	10 hospital beds and 1 emergency vehicle	565,000
Garfield:		
1980	0	0
1985	3 hospital beds	165,000
1990	3 hospital beds	165,000

TABLE G3-8

CAMEO INCOME

Year	Employment	Payroll	Total Regional Income
1980	426	$7,071,600	$10,748,830
1985	375	6,225,000	9,462,000
1990	399	6,623,400	10,667,570

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce or eliminate specific adverse impacts of General Exploration Company's (GEX's) proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the mining and reclamation plan is approved, they would be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

GEX Mitigating Measure 1

Guzzlers will be constructed in Coal Gulch and Coal Creek for chukars.

GEX Mitigating Measure 2

Application of surfactant or foam to coal entering the raw storage pile at the Cameo mines will be required as a condition for concurrence by BLM with the M&R plan.

Analysis of Effectiveness

GEX Mitigating Measure 1

The guzzlers will allow the chukars access to water away from the Highline Canal and thereby reduce the possibility of the birds being disturbed by the mining activity.

GEX Mitigating Measure 2

GEX proposes to control air pollution derived from the storage pile by watering. The use of surfactant or foam will increase control efficiency from 50 percent (for watering) to approximately 90 percent. This would result in an emission reduction from 10 tons per year to 2 tons per year.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by construction and operation of General Exploration Company's (GEX's) proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

Table G5-A presents the ambient concentrations expected for the peak study as a result of the mitigating measures. The Cameo mines would increase annual average particulate concentrations by 4 micrograms per cubic meter ($\mu g/m^3$) in a small area on the mine site near the preparation plant and refuse pile. Concentrations are predicted to increase by at least 1 $\mu g/m^3$ for a distance of 0.5 to 1 mile from the surface facilities. Maximum 24-hour concentrations from the mine about 0.5 mile down the canyon would be 20 $\mu g/m^3$ in 1980, 23 $\mu g/m^3$ in 1985, and 24 $\mu g/m^3$ in 1990. Visibility would be reduced less than 2 miles on an annual basis by 1990.

Geologic and Geographic Setting

Topography

Installation and use of the refuse disposal area and subsidence would cause minor alteration of the land surface. Under worst case conditions, subsidence may cause fracturing and slumping of the surface resulting in an erosion hazard and a danger to any surface use of the area.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

TABLE G5-A

TOTAL ANNUAL PARTICULATE EMISSIONS

(ton/yr)

Study year	Without mitigating measures	With mitigating measures	Percent reduction
1980	52	44	15
1985	60	52	13
1990	82	74	10

Soils

Surface disturbance on approximately 164 acres already disturbed and an additional 69 acres by 1980 at the mine site would cause an increase in erosion and a deterioration of soil structure and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would prolong the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 10 acres from a production function by 1980, 134 acres by 1985, and 169 acres by 1990. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine site on 233 acres through 1990 (164 acres already disturbed and 69 acres additionally disturbed by 1980). If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than these figures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action

Wildlife

Approximately 233 acres of habitat, which would have supported 43 deer, would be lost through 1990.

Activity near the mine has already caused loss of hunting habitat for the peregrine falcon, and further disturbance of this habitat could cause additional stress on the birds. In addition, human activity around the cliffs could cause their abandonment as nesting habitat and the subsequent loss of the birds.

Mineral Resources

The removal of the coal under the GEX proposal would have an unavoidable effect on the coal seams and the coal reserves by the depletion of a nonrenewable energy deposit. Based on estimates, approximately 22.91 million tons of coal would have been mined by 2025, which would constitute approximately 2.1 percent of the total coal reserves over 42 inches in thickness in the Mesa County portion of the Colorado section of the Bookcliffs coal field. Because of the nature of underground caving and resultant high contamination, future recovery of the abandoned approximatly 50 percent of the coal reserves is not considered feasible with present technology, and therefore those reserves must be considered as lost.

Water Resources

There would be an increased consumption of municipal water of 46 acre-feet per year in 1980, 617 acre-feet per year in 1985, and 780 acre-feet per year in 1990.

There would be unquantifiable degradation of water quality of the Colorado River from runoff through the mine area from any precipitation event larger than 10-year/24-hour storm.

There would be an unquantifiable reduction in water quality of the Colorado River due to increased municipal wastes associated with population increases due to the proposed action.

Cultural Resources

Unidentified sites could be damaged during surface disturbing activities and subsidence.

Transportation

Greater traffic on U.S. Highway 6 and I-70 would increase accidents and congestion. The two to three unit trains moving the coal to the consumer would increase congestion on rail facilities. Passenger traffic at Walker Field would also increase.

Livestock

Increased off-road vehicle use would decrease productivity of natural vegetation by an unquantifiable amount. Agricultural lands disturbed by urban expansion would result in the loss of an unquantifiable amount of livestock forage and livestock wintering areas.

Recreation

If the community recreational facilities needed to prevent deterioration of existing facilities is not provided, this deterioration would be an unavoidable adverse impact.

Visual Resources

The expansion and visual intensification of the Cameo industrial area would further degrade the natural appeal of DeBeque Canyon, and additional surface disturbance would expand the visual influence of the industrial landscape character.

Socioeconomic Conditions

The Grand Junction area would receive new employment and population resulting from the Coal Canyon, Cottonwood Creek, and Cameo mines, but that population would be only a small

portion of the total population increase expected in Grand Junction. The entire Grand Junction area's ability to absorb population growth is expected to be severely strained between 1978 and 1985, with the new population brought in by these three mines compounding the problem.

The revenue generated by local property and sales taxes in Mesa and Garfield counties from the Cameo mines would lag behind the increased expenditures needed for community facilities, to 1985 in Mesa County and through 1990 in Garfield County. Increased school revenues from the project would more than offset increased school costs in Mesa County, but the school districts in Garfield County would require about $110,000 annually for school costs resulting from the project, in addition to what would be generated locally from increases in the tax base.

About 122 acres of land in Mesa County and 47 acres of land in Garfield County would have to be converted to residential use to accommodate increased population resulting from the Cameo mines.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 22.91 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment.

There would be the following alterations in the short term, a period beginning with on-site construction and ending with end of mine life (about 2030) and the post-mining reclamation:

1. An estimated 22.91 million tons of coal would be exported to midwestern utility plants for use in the production of electrical energy.

2. Annual average particulate concentrations would increase by 4 micrograms per cubic meter ($\mu g/m^3$) near the preparation plant and refuse pile and by 1 $\mu g/m^3$ for a distance of 0.5 to 1 mile from the surface facilities. Maximum 24-hour concentrations from the mine about 0.5 mile down the canyon would be 24 $\mu g/m^3$. Visibility would be reduced less than 2 miles on an annual basis.

Predicted maximum 24-hour concentrations in the DeBeque Canyon area would be about 150 $\mu g/m^3$ and would occur near the Cottonwood Creek site. The maximum particulate concentration for the DeBeque Canyon area would be 69 $\mu g/m^3$. This maximum concentration would occur in the vicinity of the bridge across the Colorado River and would be aggravated by the coal hauling activities of the Cottonwood Creek mine. Estimated source contributions of approximately 4 of the 69 $\mu g/m^3$ would be caused by the Cameo mines, 40 are due to background, 2 are due to existing sources, 3 would be caused by the Coal Canyon mine and 20 would be caused by Cottonwood Creek mines. The maximum concentration of 69 $\mu g/m^3$ is below the primary standard of 75 $\mu g/m^3$, but 9 $\mu g/m^3$ above the secondary standard of 60 $\mu g/m^3$. The area exceeding the secondary standard would be less than 1 square mile, centered around the combined loadout facility.

3. There would be loss of soil productivity on 233 acres through 2025 due to increased erosion, deterioration of soil structure, and reduced biological activity, and there would be loss of vegetation on those 233 acres through 2025 due to loss of soil productivity.

4. Wildlife habitat on 233 acres, which could have supported 43 deer annually, would be completely lost through 2030.

5. Increased traffic from coal haulage and from employees would increase the number of road accidents.

6. Six unit trains per week would increase congestion on area rail facilities.

7. The entire Grand Junction area's ability to absorb population growth is expected to be severely strained between 1978 and 1985, with the new population brought in by the Cameo mines compounding the problem. I128. The revenue generated by local property and sales taxes in Mesa and Garfield counties from the Cameo mines would lag behind the increased expenditures needed for community facilities to 1985 in Mesa County and through 1990 in Garfield County. The school districts in Garfield County would also require about $300,000 for school costs resulting from the Cameo mines.

9. Total direct, indirect, and induced income generated by the Cameo mines would be $1,067,570 by 1990.

Residual effects of mining (after post-mining reclamation) on long-term productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.

2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.

3. An estimated 22.91 million tons of coal, a nonrenewable energy resource, would be depleted after 2030.

4. The long-term effect on the land surface could be substantial, if subsidence is not prompt and complete, or if fire from spontaneous combustion should start.

5. There would be an increased consumption of at least 780 acre-feet of municipal water per year through 2030.

6. Soil and natural vegetative productivity would be permanently lost on 169 acres due to urban expansion.

7. Surface construction subsidence, and vandalism would distrub or destroy an unquantifiable number of nonrenewable cultural resources.

8. Archeological survey and excavation could provide gains in understanding or prehistoric use in the area.

9. If peregrine falcons are forced to abandon their nest sites near the mines, their long-term productivity could decrease.

10. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present failities would be a long-term adverse impact.

11. The development of the coal mines would intensify the exising industrial image of the landscape, and some facilities would become permanent modifications. Long-term rehabilitation would improve some acreage, but the landscape image would change only marginally as long as the Cameo Power Plant and facilities are functioning.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 22.91 million tons of coal would be recovered from the Cameo mines. About 22.91 million tons would be lost due to current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 233 acres for the life of the mine and irreversibly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 233 acres, which would have supported 43 deer annually, would be irretrievably lost for the life of the mine.

The commitment of this area to mining could cause an irretrievable loss of peregrine falcons and their nesting habitat and subsequent loss of the birds nesting in this area.

Anything other than in-place preservation of archeological resources would be an irreversible, irretrievable commitment of the resource. Damage from surface disturbance would result in permanent loss of information and would remove those archeological values from future research consideration.

The expansion of the Cameo industrial complex would further commit the viewshed to a form of development which is less of a scenic amenity than the canyon landscape in a natural state. Future populations would be committed to this alteration and its influence on the total DeBeque Canyon visual environment, which is incrementally being altered from a natural condition that offers the greatest visual enjoyment.

An irretrievable commitment of capital and land (at least 169 acres) would be required to support population growth.

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan is not approved. Rejection of General Exploration Company's (GEX's) proposed M&R plan would result in no environmental impact from coal mining on federal leased lands. Since these lands are public lands, surface use would be governed by Bureau of Land Management (BLM) policy and management guidelines and decisions. GEX could submit a new M&R plan, challenge the rejection, or abandon development of the lease.

Since GEX's mining plan involves other adjacent private holdings, it is probable that the company would still develop private coal from the Cameo No. 1 Mine since no federal action would be required. No estimate is currently available of the acreage of private coal to be mined or the amount of coal which could be produced. As currently projected, however, the private coal reserves of the Cameo Mine property would be exhausted by 1990, and mining would have stopped by then. The entire area overlying the private reserves which are mined would be subject to a maximum of 8 feet of vertical subsidence.

Coal from the proposed Cameo mines is intended to supply 22.9 million tons of coal to midwesten utility plants for use in the production of electrical energy. Potentially, production from private reserves in the Cameo No. 1 would not be sufficient to supply these markets.

Cameo's operation would probably increase annual average particulate concentrations by 1 to 4 micrograms per cubic meter in the immediate vicinity of the Cameo No. 1 Mine. However, once the private reserves are exhausted and the mine is closed down, future air quality would be nearly the same as current air quality, about 42 micrograms per cubic meter.

There would be some continued loss of soil and vegetative productivity to 1990 due to increased erosion, deterioration of soil structure, and possible subsidence. The existing disturbance on 164 acres would remain due to the operations continuing in private coal.

An unquantifiable amount of wildlife habitat (at least 164 acres) would continue to be lost through 1990.

Subsidence or vandalism would destroy or disturb an unquantifiable number of cultural resources. Paleontological resources would be impacted both adversely and beneficially in approximate proportions to the level of regional development and the area disturbed.

The population of Mesa County would still increase at a rapid rate to 88,250 people in 1980, 109,200 people in 1985, and 109,300 people in 1990, primarily due to development of oil shale and uranium and the area's role as a regional center. Garfield County is also projected to grow at a rapid rate to 34,100 people in 1980, 42,900 people in 1985, and 46,600 people in 1990, also due to oil shale development

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transport, and rates of production have been considered, but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geologic and geographic characteristics of the area. Any new alternatives which are presented during the review process will be carefully considered.

SHERIDAN ENTERPRISES:

LOMA PROJECT

CHAPTER 1

DESCRIPTION OF THE PROPOSAL

Proposed Action

The proposed action is the review and consideration for approval of a mining and reclamation plan (M&R plan) submitted by Sheridan Enterprises, Inc., to the Area Mining Supervisor of the U.S. Geological Survey (USGS), Denver, Colorado, on March 14, 1978. The M&R plan has been accepted by the USGS as suitable for use in preparing this environmental statement (ES) and is available for public review at the Area Mining Supervisor's Office in Denver.

This M&R plan was submitted for review after promulgation of the initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), but it has not been officially reviewed for compliance with that act. The applicant's plan may not fully reflect the requirements of the initial regulations. However, in this statement the initial regulations are considered as required federal mitigating measures the same as all other applicable regulations.

The M&R plan will be returned to the operator for revision in accordance with the applicable initial regulations. As soon as the applicant's plan is revised and returned to USGS, it will be evaluated with the Office of Surface Mining to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The M&R plan cannot be approved until it conforms to all applicable federal requirements.

The mining complex, designated as the Loma project (map S1-1) would be located about 35 miles northwest of Grand Junction, Colorado, in western Garfield County, in the Colorado portion of the Little Bookcliffs Coal Field. The Loma property consists of federal coal leases C-0125436, C-0125437, C-0125438, C-0125439, C-0125515 and C-0123316, located in the Douglas Pass area of western Garfield County, Colorado, totalling 14,929.23 acres. The federal lease conditions are subject to all current surface mining reclamation and related land use requirements and all laws and regulations affecting federal coal leases.

The proposed Loma Project would consist of six new underground, bituminous coal mines with an anticipated annual production of 5 million tons of coal per year and an employment level of approximately 900 at full production. Each mine may vary as to size, production, equipment, and mining systems, depending on location, coal quality, mining conditions, and markets. Recoverable reserves of the total project are estimated to be 100 million tons. The mine life would be for a period of approximately 25 years.

Coal from the project would most likely be transported by rail to utility markets in the midwest and southwest areas.

History and Background

Historically there has been no coal mining in the Douglas Pass area. The abandoned McKinley Mine, located approximately 12 miles southeast of the area, is the nearest coal mine to the proposed mining operation. There is no previous experience in mining operations to rely on, in the project area.

In 1966, prospecting permits were issued to Industrial Resources, Inc., for exploration in the Douglas Pass area. In 1968, after the USGS had determined that Industrial Resources had discovered a commercial coal deposit, preference right leases C-0125436, C-0125437, C-0125438, C-0125439, C-0125515, and C-0125516 were issued to Industrial Resources. These leases were assigned to Sheridan Enterprises, Inc., on January 1, 1978.

On December 1, 1975, the USGS Area Mining Supervisor approved a prospecting development and mining plan submitted by Sheridan Enterprises for Industrial Resources for operations on these leases. The underground exploration work is designed to provide test data to confirm whether there are sufficient economically recoverable resources to support a viable mining operation. No subsequent commercial operations have been authorized or approved.

The exploration work involves driving sets of five exploratory entries for a distance of 5,000 feet at four different locations. Each set of entries is to be located in a geomorphically distinct area of the leases. Test data on coal quality and variations, roof conditions and necessary support methods, ground water conditions, gas emissions, equipment capabilities, and other mining conditions will be obtained. Coal produced by the exploration mining is being subjected to test burns by various potential customers, such as electric utilities and industrial

companies. Bulk samples are being tested for its beneficiation characteristics. All of the surface facilities at each of the exploration mining sites would be temporary.

In mid-1977, test mining was started at a site in McClane Canyon in Section 21, T. 7S., R. 102W. Another test mine was started at a site in Munger in Section 27, T. 7S., R. 102W. in late 1977; figure S1-1 is an aerial photograph of that site.

From exploration by drill holes, Sheridan Enterprises has determined that most of the economically mineable coal in the project area is in the Cameo seam. An unnamed upper coal seam (Sheridan uses 'Loma seam' for identification purposes) appears to be of economic importance in the extreme northeastern portion of the lease area. The seams occur in Sections 3, 4, and 10 T. 7S., R 102W.

Predisturbance Inventories and Analyses

In early 1978, BLM in cooperation with Sheridan Enterprises completed a vegetative study of the areas that are to be disturbed by the Loma project. Also, R.V. Lord & Associates, Inc., Boulder, Colorado, made a soil, vegetation, and wildlife reconnaissance of the McClane and Munger site and one proposed site in Spink Canyon. A partial archeological study was also done by R.V. Lord; a complete archeological study will be conducted for the Loma project by the company in consultation with BLM. The Colorado Division of Wildlife performs annual wildlife surveys of the area.

Stages of Implementation

Sheridan Enterprises, Inc., plans to continue ongoing exploration mining activities. The entry systems developed during the exploration mining phase would be developed into permanent portal sites (map S1-2). The company estimates that construction of the mine support buildings and the access and main haulage roads would be started in 1980, with construction completion estimated by late 1982. Construction of the central processing facilities (map 20 in appendix A) and the rail spur (map S1-3) would begin in 1980 with completion scheduled by mid to late 1982. A work force of 173 employees is estimated during the construction period.

The initial two mines would begin production in late 1982 and would reach production capacity of 1.7 million tons of coal per year by 1985, at which time the work force would be increased to approximately 472 employees. Additional new mines would be started at intervals to meet the demand.

The complete project consisting of six mines, producing about 5 million tons of coal annually with a work force of approximately 900 employees, would be operating by 1990. The company estimates its employment would increase at the rate of 100 employees per year from 1985 to full production in 1990.

Mine Layout

The initial development of the main entries of each mine would begin at the coal outcrop. Mine portals are proposed at the locations shown on map S1-2.

Development of the main entries would utilize a five-entry system. The outside two entries would be utilized as main ventilating returns, allowing a split ventilation system. The inner three entries would be used for fresh intake air, main belt conveyor, haulageway for materials, and miner access.

Development of the bleeder system entries would utilize three and four entries with one entry as a return airway, one as a belt conveyor entry, and one or two entries for fresh air intake, materials haulage, and access.

Development for both longwall panels and room-and-pillar panels would utilize a three-entry system which would provide for a return airway, belt conveyor entry, intake airway, material haulage, and access.

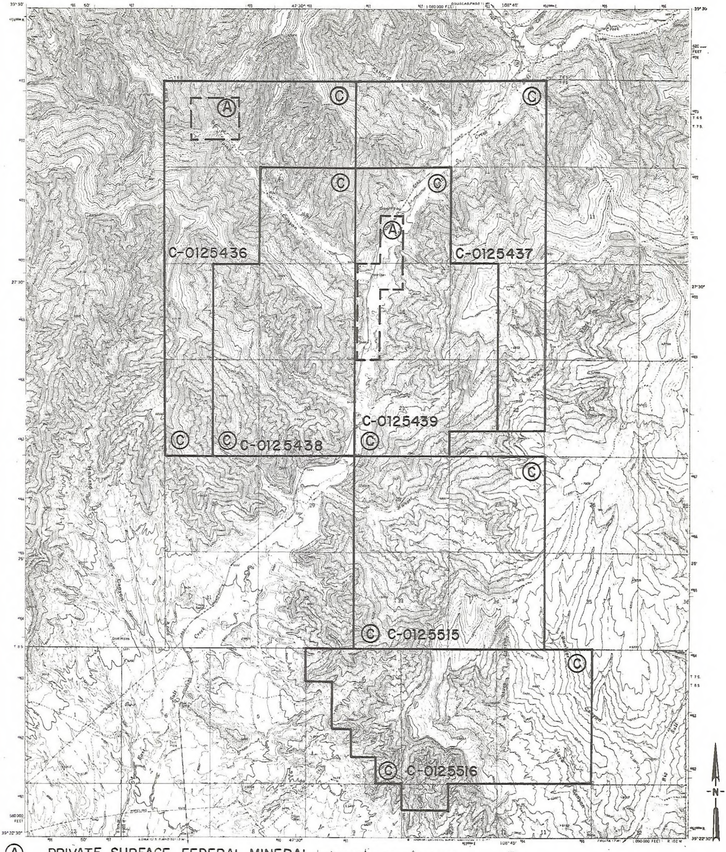
Adequate barrier pillars, 100 to 200 feet in width, would be provided to protect the bleeders and main entries. All entries would be 18 to 20 feet wide on 70- to 90-foot centers, with crosscuts on 100-foot centers for the full seam thickness up to a maximum of 12 feet of coal. Higher entries could create rib spall and roof control problems. All development work would be accomplished with continuous miner units.

Longwall mine panels would employ a retreat mining method with longwall shearing beginning at the barrier pillar of the bleeder entries and mining toward the main entries. Panel lengths would vary from 5,000 to 7,000 feet with face widths varying from 500 to 600 feet. A maximum height of 14 feet is proposed for longwall mining.

Room and pillar mining would be accomplished by continuous miner units. Panel entries would be driven off the main entries at intervals, to provide rooms 340 feet long on one side of the panel entries. The rooms would be mined 20 feet wide on 45-foot centers to room depth (length); pillars would be extracted on retreat. Full seam thickness would be mined to a height of 12 to 14 feet.

Each of the mines would have, at one time, up to five mining units, that is, up to four continuous miners and one longwall unit. Table S1-1 lists typical mining equipment to be used.

A minimum roof control plan has been formulated for normal roof conditions using the mining methods described. The support practices which may be involved include mechanical roof bolts, steel mats, timber, wooden crossbars, and resin anchored bolts. In areas where subnormal roof conditions are encountered or anticipated, additional

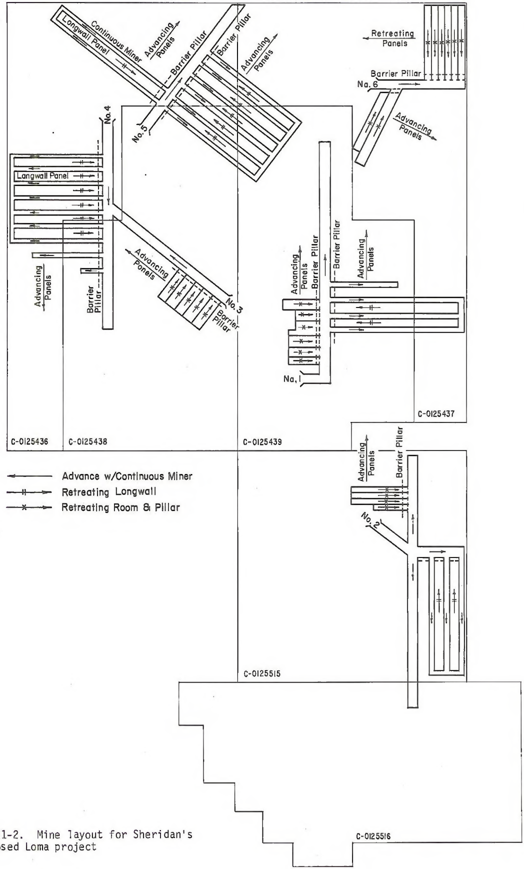


Ⓐ PRIVATE SURFACE, FEDERAL MINERAL
Ⓑ PRIVATE SURFACE, PRIVATE MINERAL
Ⓒ PUBLIC LAND SURFACE, FEDERAL MINERAL

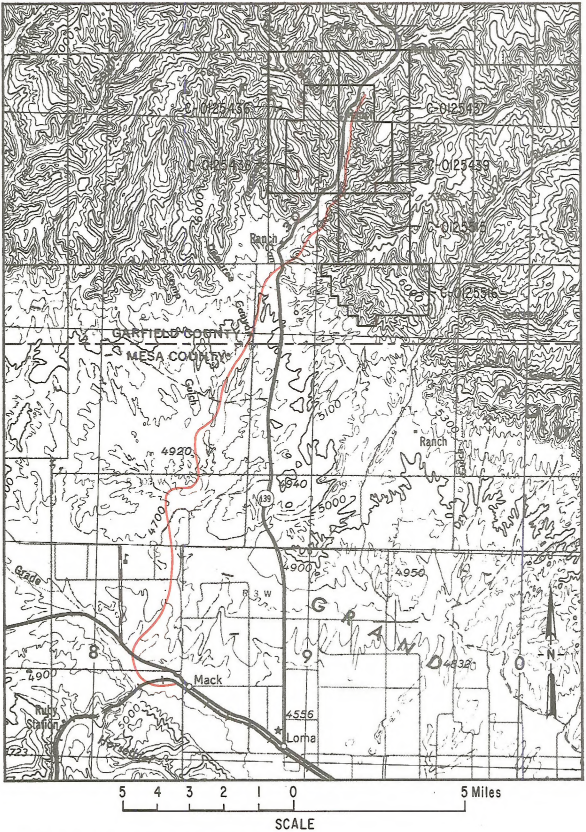
FEDERAL LEASE
PRIVATE LEASE

Map S1-1. Sheridan Enterprise's Loma project lease area

Figure S1-1. Looking southeast at the Munger Canyon exploration adit operated by Sheridan Enterprises. At the completion of exploration activities, Sheridan proposes to convert this adit into a producing mine.



Map S1-2. Mine layout for Sheridan's proposed Loma project



Map S1-3. Sheridan's proposed utility corridor

TABLE S1-1

TYPICAL MINING EQUIPMENT LIST FOR LOMA PROJECT

Face Equipment	General Underground Equipment
Development Sections and Room-and-Pillar Sections:	
Continuous miner	Main line belts for coal haulage to surface
Diesel haulage cars	Track (no trolley wire)
Roof bolter	Diesel/battery supply - miner haulage vehicles
Battery scoop	Roof bolter
Transformer	Rock duster
Panel belts - 36" and 42"	Pump stations
Rock duster	Supply cars
Face ventilation fans	Air compression station
Feeder-breaker	Fire car station
Diesel fuel storage tanks	Battery/diesel cleanup vehicles
Longwall Section:	
Shield supports	
Double-ended ranging drum shearer	
Armoured face conveyor	
Master control station	
State loader	
Transformer and electric boxes	
Panel belt - 42 inches	
Power-pack system	
Rock duster	

support methods may necessitate changes in roof control; the roof control plan would be modified and approval would be obtained from the Mine Safety Health Administration (MSHA) before the new method was implemented. Ventilation and safety plans must also have MSHA approval.

No. 1 Mine

In the No. 1 Mine, with portals in McClane Canyon, Sheridan has developed five exploration entries eastward from the coal outcrop to about 1,400 feet, where a fault was encountered. The mining plan proposes these entries as permanent main entries. These mains would be turned north just before the fault and developed northerly for about 11,000 feet. Longwall panels would commence on the east side of the north mains at 2,000 feet north of the fault. The longwall panels would be successively developed by advancing entries, then mined on retreat. The longwall panels would be developed successively to the northern limits of the north mains on 700-foot centers.

Room-and-pillar panels would be developed to the west of the north mains with room panels extending until bad coal is found, or to the burn line in the outcrop zone. Room-and-pillar panels would be mined successively beginning at the 200-foot barrier from the east mains and progressing north to the limits of the north main entries.

Main entry barrier and chain pillars would be mined on retreat by continuous miner units upon completion of the longwall and the room-and-pillar mining.

No. 2 Mine

At the No. 2 Mine with portals in Munger Canyon, five entries are being developed from the coal outcrop during ongoing exploration. Sheridan proposes to develop them as permanent main entries. These mains would be developed about 2,000 feet southeast and then about 2,400 feet east to the property barrier pillar.

At 2,000 feet inside the portals, a main entry system would be turned south and developed about 12,500 feet until bad coal is found or until the south lease boundary barrier pillar is reached. A main entry system would also be turned north and developed for about 4,000 feet to the property barrier pillar. Longwall mining would be done south and north from the east mains and east of the north mains and south mains. Room-and-pillar panels would be developed on the west of the north main toward the coal outcrop zone; longwall mining may be done west of the south mains. Main entry barrier and chain pillars would be mined on retreat by continuous mining units upon completion of the longwall and the room-and-pillar mining.

No. 3 Mine

Sheridan proposes to open a five main entry system at the No. 3 Mine with portals in the Cameo seam of East Salt Creek. The system would be in the coal outcrop on a relatively narrow mountain ridge formed by two separate, local, drainage features about 4,000 feet apart. The Cameo seam is extensively burned along the outcrop in this area, making the mineable area unsuitable for longwall mining. Therefore, only room-and-pillar mining methods would be utilized. The main entries would be developed about 6,000 feet toward the northwest.

Room-and-pillar panel entries, in sets of three entries on 70-foot centers, would be turned toward the southwest beginning about 200 feet inside the portals, or at a greater distance if necessary to encounter saleable coal inside any burn line. These panels would be developed successively on 520-foot centers to provide panels with 340-foot rooms. The room panels would be developed about 1,600 feet in length or to the burn line. Room-and-pillar panels would be mined on retreat to the main entry barrier pillar. It is assumed that room-and-pillar panels would be mined on the southwest of the main entries to the burn line by retreat panel mining beginning at the inside end of the main entries by the same mining sequence. Main entry barrier and chain pillars would be recovered by retreat methods upon completion of mining of the room-and-pillar panels.

No. 4 Mine

Sheridan proposes to open a five main entry system for the No. 4 Mine in the coal outcrop on the south side of Spink Canyon. The main entries would be developed south for a distance of 9,400 feet by continuous miner units. Longwall panels would be developed west about 4,200 feet from the mains to the lease boundary barrier with extractions of the coal by retreat toward the mains. The longwall panels would be developed by the advancing entries. The area to the east of the main entries would be mined from the No. 3 Mine. Main entry barrier pillars and chain pillars would be recovered by retreat methods upon completion of the longwall panel mining.

No. 5 Mine

The No. 5 Mine portals would be in the coal outcrop on the north side of Spink Canyon. The five main entries would be developed to the northeast for about 7,000 feet to the barrier pillar at the north boundary of the lease lands. Longwall panels about 5,400 feet in length would be developed to the southeast of the main entries. Longwall panels northwest of the main entries would be developed over varying lengths of 1,000 to 6,200 feet. Main

entry barrier pillars and chain pillars would be recovered by retreat methods upon comletion of longwall mining.

No. 6 MINE

The No. 6 Mine with portals in the Loma seam of East Salt Creek would be opened in the outcrop of the Loma seam in the only area on the lease lands currently known to contain the seam in mineable quantity and quality.

The five main entry system would be developed about 4,000 feet east from the portal to the boundary barrier pillar. The area containing mineable coal is not suitable for longwall mining; therefore, the entire block of coal would be mined by the room-and-pillar method. Panels would be developed north from the main entries beginning at the boundary barrier pillar. The panels would be 3,500 feet in length with rooms 340 feet deep. Each panel would be mined on retreat toward the portal area. Room-and-pillar panels of variable lengths would be developed toward the southwest south of the mains. These panels would be mined by advancing panel methods. Main entry barrier pillars and chain pillars would be mined by retreat methods upon completion of the room-and-pillar mining.

VENTILATION

At each mine, a main ventilating fan would be installed on the surface and offset not less than 15 feet from the nearest mine opening. The fan would be installed in fireproof housing and connected to the mine opening by fireproof air ducts. The fan would be equipped with a pressure-recording gauge and an automatic alarm-device should the fan slow or stop. The fan would be powered by an electric motor on a separate power supply that would be independent of any other mine circuit.

The intake and return entries would be separated by permanent, substantial, incombustible stoppings to and including the third crosscut out from a working face. Separation of the entries inside this point would be by check curtains. Line brattice would be installed to the last support in each entry that has not been cut through. Coal would not be permitted to accumulate at the outside end of the face equipment to the extent that ventilation of the working face is restricted.

HAULAGE SYSTEMS

Coal would be transported from a working face to the main underground conveyor belt by diesel powered shuttle cars. From the conveyor belt, the coal would enter a surge bin on the surface, then be transported to the central processing facilities by 55-ton coal haulers. Dust would be controlled by water sprays at the working face, at all loading points, and at all transfer points.

Surface Facilities

Approximately 676 acres would be required for facilities, which would include access and haul roads, office/shop/warehouse complex, processing plant complex, railroad and utility corridor, water and sewage treatment complex, mine portal complexes, and a refuse disposal site. (Map 20 in appendix A shows the proposed surface facilities; figure S1-2 is an aerial photo of the site.)

ROADS

The main access road to the Loma project is Colorado Highway 139 (Douglas Pass Road) from Loma, Colorado. Primary access to the project would be over graveled roads, a minimum of 30 feet wide.

The on-site haul roads that would be used for coal haulage from the various mine-portal areas to the central processing facilities would be graveled roads, 50 feet wide. Those roads that would be used for both coal haulage and for refuse disposal would be graveled roads, 80 feet wide. Table S1-2 shows the surface disturbance of the various access and haul roads that would be constructed on the Loma project.

Approximately 3,000 feet of access road in McClane Canyon already exists but would be widened to 50 feet for coal haulage; 4,300 feet of access road exists in Munger Canyon but would be lengthened and widened to 50 feet for coal haulage.

Construction of the access and haulage roads would be by private contractors. Estimates were given that the access road construction would take approximately two months per mile per ten-worker crew, and the haul road construction would take three months per mile per ten- worker crew.

OFFICE/SHOP/WATERHOUSE COMPLEX

Approximately 6.2 acres would be disturbed by the office/shop/warehouse complex. The complex would consist of a main office building, major repair shop, analytical laboratory, supply yard, underground fuel storage tanks, water supply and treatment facilities, sewage treatment facility, and parking area.

CENTRAL PROCESSING COMPLEX

The central processing facilities would disturb approximately 13.2 acres. These facilities would include a coal processing plant, 20,000- ton raw coal storage area, 20,000-ton clean coal storage area, 20-foot diameter refuse bin, railroad loadout facility, crushing unit, conveyor system, water supply and treatment facility, sewage treatment facility, bathhouse, power distribution system, and parking area.

Figure S1-2. Looking northwest up Spink Canyon from East Salt Wash. Central facilities for Sheridan's Loma project will be located in East Salt Wash in the foreground. B marks the proposed site of two portals for the Loma project. The distance from point a to a' is approximately 1 mile.

RAILROAD AND UTILITY CORRIDOR

The 200-foot railroad and utility corridor for the Loma Project would start approximately 1 mile west of Mack, Colorado. The corridor would contain the railroad spur, power line, and water line. It would follow the East Salt Creek drainage, extending approximately 20.5 miles to the loadout area of the project (see map S1-3). Approximately 497 acres would be disturbed. A power substation would have to be constructed within the corridor near Mack, Colorado, because none now exists. Sheridan has not yet applied for a right-of-way for this corridor over the public lands but is in the process of negotiating for rights-of-way over private lands. Although the exact location of the corridor is not firmly committed, the corridor has been included in this ES for purposes of impact analysis. Once the route has been finally selected and the railroad spur has been designed, then additional environmental assessment may be required if the route significantly varies from what is being analyzed in this ES.

WATER AND SEWAGE TREATMENT

The company estimates that approximately 10 cubic feet per second of water would be acquired for the Loma operation. The water would be diverted from the Colorado River approximately 2.5 miles south of Loma. The water would be pumped via an 8- to 10-inch pipeline along the U.S. Highways 6 and 50 rights-of-way, through the utility corridor, to the project area.

Sewage treatment would be by a septic tank and leach field system at each of the portal sites, at the office/shop/warehouse complex, and the central facilities.

MINE PORTALS

Approximately 24.5 acres would be disturbed for the life of the mine for construction and maintenance or portal areas. The areas to be disturbed by the mine portal sites are listed in table S1-3.

REFUSE DISPOSAL

Approximately 40 acres of surface would be disturbed in the proposed refuse disposal area. Coarse refuse in solid form and fine refuse in slurry form would be disposed of in the refuse pile. Specific details of the construction of the refuse pile were not given in the M&R plan. However, the refuse would be disposed of in compliance with 30(CFR): 211 and 30(CFR): 700 regulations.

All suitable and available topsoil would be removed from the areas to be disturbed by conventional rubber-tired scrapers and stockpiled near the place of removal. The stockpiles would be compacted by multiple passes of the scrapers to obtain a density conducive to soil stability. The stockpiles would be mulched and seeded with approved mixtures to minimize erosion. Sedimentation ditches would be constructed on the down gradient side of the stockpiles. Sediment cleaned from the ditches would be placed back on the stockpiles.

Surface Reclamation

Abandonment of the Loma project at the completion of mining would consist of removing all structures, pads, temporary diversions structures, and sedimentation ponds; regrading and recontouring all affected areas to approximately the original contour; and scarifying these areas. The topsoil would be replaced, fertilized if necessary, and seeded by seed-drill or broadcasting with an approved seed mixture. All portals would be sealed in accordance with applicable federal and state requirements. The area would be returned to its former use in a manner that is suitable to that use as required by 30(CFR): 700.

Authorizing Actions

This M&R plan was submitted for review after promulgation of initial regulations, 30(CFR): 700, required under Section 502 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), but it does not fully reflect the requirements of the initial regulations. However, in this statement the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial regulations. Before the plan is forwarded for approval by the Secretary of the Interior, it will be returned to the mining company for redesign to incorporate the applicable initial regulations.

As soon as the applicant's plan is revised and returned to USGS, it will be evaluated with the Office of Surface Mining (OSM) to determine compliance with the requirements of federal regulations in 30(CFR): 211 and 30(CFR): 700. The M&R plan cannot be approved until it conforms to all applicable federal requirements.

The regulations contained in 30(CFR): 717 deal specifically with the performance standards required for approval of underground mining such as that proposed in this plan. In addition, refuse disposal of mine waste materials is governed by the regulation 30(CFR): 715.15. The standards and measures described in those regulations are considered as required measures and the analysis of impacts from the proposed action have been analyzed on that basis.

Federal Agencies

Before approval of the M&R plan is granted, BLM must concur with Sheridan's proposal following redesign according to 30(CFR): 211 and 30

TABLE S1-2

SURFACE DISTURBANCE OF LOMA PROJECT ROADS

Area	Access (length, feet)	Access (width, feet)	Haul (length, feet)	Haul (width, feet)	Total Acres
Mine No. 1 (McClane Canyon)	-	-	3,000	50	3.4
Mine No. 2 (Munger Canyon)	-	-	9,000	50	10.3
Mine No. 3 (East Salt Creek)	-	-	3,000	80	3.4
Mine No. 4 (Spink Canyon)	1,000	30	8,000	50	10.6
Mine No. 5 (Spink Canyon)	1,000	30	-	-	0.7
Mine No. 6 (East Salt Creek)	-	-	220	50	2.6
Central Facilities (East Salt Creek)	2,000	30	9,000	80	17.9
				Total	48.9

TABLE S1-3

AREAS TO BE DISTURBED BY MINE PORTAL SITES

Mine		Acreage Disturbed
No. 1		1.7
No. 2		2.6
No. 3		3.0
No. 4		4.0
No. 5		7.0
No. 6		6.2
	Total	24.5

(CFR): 700 regulation and review by USGS and OSM. Before mining could begin at the Loma Project, BLM would also have to issue rights-of-way for the railroad spur and utility corridor from Mack, Colorado, to the Loma project.

USGS would, with BLM concurrence, approve the M&R plan. OSM would review the M&R plan and approve it along with USGS.

Sheridan will have to consult with the Corps of Engineers to determine if a '404 Permit' under the Federal Water Pollution Control Act (regulations are in 33(CFR): 209.12) is needed before the company can withdraw the 10 cubic feet per second of water needed from the Colorado River.

State and County Agencies

Air quality, solid-waste disposal, water quality, and mining and reclamation of mined land must comply with rules and regulation administered by the various divisions within the Colorado Department of Natural Resources. Approval of the M&R plan, permits, and licenses to mine coal must be obtained from the state of Colorado.

Sheridan has obtained the necessary permits from Garfield County for conducting a mining operation. Sheridan will have to obtain necessary authorization from Mesa County for its pumping station on the Colorado River and associated water line to the Loma Project.

Interrelationships

Relationship to Other Developments

At present no other operators mine coal in the immediate area of the Sheridan Enterprises, Inc., federal coal leases. The proposed Loma project would be the first coal mining operation in the Douglas Pass area. Coal Fuels Corporation currently owns private coal reserves, including the old Farmers Mine site, 12 miles south of the Loma project. Coal Fuels plans to develop these private reserves.

The Douglas Pass area contains two known geologic structures, or producing oil and gas areas: the Coal Gulch and South Canyon fields. (Map 1 in appendix A shows the relationship of these fields to the Loma Project.) In addition, oil and gas exploration work north and west of the leases is ongoing at this time. The area is still given wildcat, or nonproducing, status. Currently there is no direct conflict for land between Sheridan Enterprises and the gas exploration companies. As exploration continues, the area of the leases may be drilled and possible conflicts may arise. Currently the Sheridan Enterprises operation in Spink Canyon uses 8 miles of road built by Petrolewis for access to exploration areas north of the leases.

Colorado Highway 139 (the Douglas Pass Road) bisects the Loma Project leases. Major existing transportation facilities, including the main line of the Denver and Rio Grande Western Railroad (D&RGW), Interstate 70, and U.S. Highways 6 and 50, are 20 miles to the south of the area (see map S1-1).

Relationship to BLM Land Use Plans

The 14,928 acres of public lands included in the M&R plan are administered by the BLM's Grand Junction District. They are subject to the management guidelines that were developed in the Baxter-Douglas- Glade Park management framework plan (MFP), completed in January 1970, and the Grand Junction Resource Area Coal Update MFP, completed in September 1977. In addition, Sheridan's proposal to construct a rail and utility corridor from Mack would involve private lands as well as public lands that are not leased to the company.

The surface overlying Sheridan's lease holdings has largely been used for livestock grazing, wildlife habitat, and hunting. Historically there has been no coal mining in the Douglas Pass area. The lands over which Sheridan would have to acquire rights-of-way are largely a mixture of farmlands near Mack and desert grazing lands for the remaining distance. The farm lands are privately owned, while the desert area is public land administered by the BLM. Some public lands are intermingled with the privately owned parcels.

CHAPTER 2

DESCRIPTION OF THE ENVIRONMENT

The description of the existing environment covers the physical, biological, and cultural resources and the socioeconomic conditions which constitute the site-specific environment in which Sheridan Enterprises, Inc., proposes to develop federal coal and adjacent private coal. The description focuses on environmental details most likely to be affected by Sheridan's proposed action and alternatives. The concluding section of this chapter describes the anticipated future environment in 1990 if the proposed action is not implemented.

EXISTING ENVIRONMENT

Climate

The climate of the study area is characterized by dry air masses, which are modified Pacific air masses that move eastward across the Rocky Mountains. Winter snows and summer showers or thunderstorms result in unusually even distribution of precipitation throughout the year. The area receives about 8 inches of precipitation annually. Prevailing winds vary greatly throughout the Upper Colorado River Basin, and are markedly affected by differences in elevation and by the orientation of mountain ranges and valleys with respect to general air movements.

Five years of upper air observations at Grand Junction show that surface based inversions occur on 84 percent of the mornings. During the afternoons they are not as common, occurring 11 percent of the time in winter but less than 3 percent of the time in other seasons. The area is subject to a relatively high frequency of stagnation situations, mostly in winter.

The proposed Loma mine site is located 20 miles north of the town of Loma at the northern edge of the Grand Valley. Mine portals are situated up short canyons off the East Salt Creek Canyon, which traverses the site in a north-northeast/south-southwest direction.

A meteorological station has been set up at the confluence of East Salt Creek and Spink Canyons. However, it has not been in operation long enough to provide adequate data. Data from Grand Junction weather station indicate that the average annual temperature is 53 degrees Fahrenheit, and annual precipitation is about 8 to 9 inches. The growing season is 188 days (based on 32-degree freeze threshold data). Evaporation is estimated to be about 45 inches annually.

In the absence of on-site wind measurements, it has been assumed that prevailing wind direction is along the major canyon or from the north-northeast. The wind rose from Grand Junction weather station has been rotated to reflect the major canyon axis, as shown in figure S2-A. Average wind speed at the Grand Junction station is 8.1 mph.

Air Quality

Particulate air quality in the study area ranges from 20 to 132 micrograms per cubic meter ($\mu g/m^3$) annual geometric mean as recorded at sixteen state, municipal, and privately operated particulate sampling sites. In undeveloped sections, particulate concentrations range from 20 to 40 $\mu g/m^3$.

A detailed air quality analysis determined that particulate concentrations in the Grand Valley in areas away from any sources were approximately 40 $\mu g/m^3$ annual geometric mean (PEDCo 1977). The calculated first and second maximum 24-hour concentrations were 130 and 112 $\mu g/m^3$, respectively.

There has been no measurement of carbon monoxide, hydrocarbon, nitrogen oxides, sulfur dioxide, or other gaseous pollutant concentrations in the vicinity of the proposed mine. Motor vehicle emissions along state highway 139 which crosses the mine site would probably raise concentrations of carbon monoxide, hydrocarbon, and nitrogen oxides slightly above background or natural levels.

Visibility at the site ranges from less than 1 mile to approximately 100 miles throughout the year. Average visibility is about 54 miles with greatest visibility occurring during spring and summer months.

Geologic and Geographic Setting

Topography

The federal coal leases controlled by Sheridan Enterprises lie near the base of the Little Bookcliffs overlooking the Grand Valley to the south. The topography of the lease area is extremely rugged (see map S1-1). The major drainage, east Salt Creek, bisects the northern portion of the lease

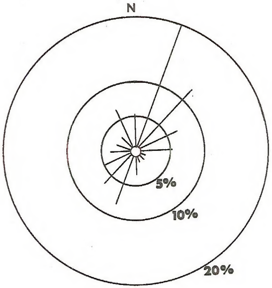


Figure S2-A. Annual wind frequency at the Loma mine site.

area, and with its tributaries divides the lease area into a series of sharp ridges and deeply-cut canyons. The creek flows southwest to the Colorado River 2 miles southwest, creating a northeast-southwest, northwest- southeast drainage orientation on the area.

Elevation on the lease area ranges from a minimum of 5,364 feet along the bottom of East Salt Creek to a maximum of 7,380 feet along the eastern boundary of the lease area. The elevation in the area rises sharply to the north-northeast due to the Little Bookcliff's escarpment. Slopes range from a minimum of 1 percent along East Salt Creek Valley to almost vertical along sections of the Little Bookcliffs. The average slope on the lease area is about 40 percent.

Landforms

In the lease area, landforms are rugged due to the differential erosion of massive resistant sandstones. Valleys are V-shaped and narrow; ridges are sharp. In addition, ribs, spurs, reentrants, and box canyons occur frequently through the area.

Structure

Strata in the lease area dip in a northeasterly direction in the range of 1 to 3 degrees with a north-northwest strike. Sheridan Enterprises reports the presence of two faults in the area which are not noted elsewhere. The first is a north trending fault which runs along the east side of East Salt Creek. The second fault parallels Spink Canyon and is located along the south canyon slope. It extends east and across the Douglas Pass Road.

Stratigraphy

Stratigraphic formations present on the lease area include the following: the late Cretaceous Mancos shale and Mesaverde group as well as the Tertiary Ohio Creek, Wasatch, and Green River formations. In addition, Quaternary and recent surficial deposits are present.

The principal coal beds through the general area and on the federal leases occur in the lower part of the Mount Garfield formation of the Mesaverde group and possibly in the Anchor Mine Tongue of the Mancos shale. At present, there is no evidence that the Anchor Mine Tongue underlies the lease area.

The Mount Garfield formation contains four coal seams (figure S2-1). In ascending order, they are the Palisade, the Cameo, the Carbonera, and a seam which Sheridan calls the 'Loma seam' for identification purposes. The Palisade coal seam lies just above the Sego sandstone, the bottom member of the Mount Garfield formation. The Palisade consists of a series of three or four normally thin overlapping lenses in a thick carbonaceous shale sequence. The seam thickness varies from 3.2 to 7 feet, contains numerous partings, and splits into two benches.

The Cameo coal seam, in which the proposed Loma mine would operate, lies about 350 feet above the top of the Sego sandstone. In the leased area, the Cameo seam is reported to be the only persistent seam of mineable thickness. Seam thickness varies from 7 feet in the northern part of the lease area to a maximum of over 23 feet on the southern edge. An estimated 100 million tons of recoverable reserves lie on the 14,929 acre lease area.

The coals of the Carbonera seam are the highest of the Mount Garfield Formation and the highest of the Little Bookcliffs. The Carbonera lies approximately 460 feet above the top of the Sego sandstone and from 60 to 100 feet above the Cameo coal seam. The Carbonera seam contains a number of individual beds (usually from one to three) of limited areal extent, which are characteristically lenticular, overlapping, and of erratic quality.

From exploration by drill holes, Sheridan Enterprises has determined that most of the economic coals in the project area are in the Cameo seam. The Loma seam, however, appears to be of economic importance in the extreme northeastern portion of the lease area.

These four coal seams lie in the lower section of the Mount Garfield formation. Although the upper portion of the Mount Garfield is lithologically similar to the lower portion, it is barren of coal. Both the upper and lower portions of the Mount Garfield contain sandstones, siltstones, shales, and carbonaceous shales. The Hunter Canyon formation, which consists of massive brown-buff and gray sandstones and gray shale, conformably overlies the Mount Garfield formation. The Hunter Canyon is the highest formation of the Mesaverde group.

Above the Mesaverde group, the Tertiary (Eocene) series begins. At the base lies the Ohio Creek formation, which is a conglomeratic sandstone. Above the Ohio Creek lie the sandstones, siltstones, and shales of the Wasatch formation. Above the Wasatch lies the Douglas Creek member of the Green River formation which consists of sandstones, siltstones, limestones, and shales. The Douglas Creek caps the highest ridges and peaks on the lease area. The Mahogany oil shale bed lies in Parachute Creek member of the Green River formation, overlying the Douglas Creek member. The Mahogany bed is absent throughout the lease area.

Paleontology

The Bureau of Land Management (BLM) has determined that compliance with the National Environmental Policy Act of 1969, as amended, and the Federal Land Policy and Management Act of 1976 requires that paleontological resources be

considered in the ES process. This includes inventory and protection through mitigation of paleontological resources having scientific, educational, or other values.

The principal fossil-bearing formations in the lease area, ages, number of known fossil localities, and general fossil types normally found in the formations are summarized in table S2-1. Due to the present lack of data and accepted criteria for determining significance, the importance of these paleontological resources to science, education, and other values cannot presently be assessed.

The BLM and U.S. Geological Survey (USGS) are currently developing a memorandum of understanding for the protection of paleontological resources on federal lands. These agencies are also developing technical guidelines to define the resource and provide criteria for evaluation and measures for protection. When approved, the provisions of these documents will serve as a basis for management and protection of paleontological resources.

Mineral Resources

Coal

Sheridan Enterprises proposes six mines to mine the Palisade, Cameo, Carbonera, and Loma (designated as such by the company) seams (see map S1-2 in chapter 1). The in-place reserves are approximately 250 million tons of coal with approximately 100 million tons of coal recoverable. Coal quality ranges are as follows: 10,500 to 11,000 BTUs, 12 to 16 percent ash, 7 to 8 percent moisture, 0.5 percent sulphur, 32 to 33 percent volatile matter, and 43 to 45 percent carbon content.

Oil and Gas

Except for the large coal reserves, oil and gas are the only potential mineral resources in the area of the proposed Loma project. The Garmesa gas field, approximately 2 miles southwest of the project area, is producing gas and is also used for gas storage. There are also four producing gas wells approximately 4 miles west of the project area. Five producing gas wells are approximately 5 miles north of the project area. All of the wells are producing gas from either the Dakota sandstone, Morrison formation, or Entrada sandstone. A number of plugged and abandoned gas wells are approximately 2 miles west of the project area; they were used for testing the above producing formations.

There is a slight potential for gas production from the project area from the Dakota sandstone, Morrison formation, and Entrada sandstone. There is only a possibility for oil production in the project area from the Dakota sandstone.

Water Resources

Surface Water

The major drainage running through the proposed lease area is East Salt Creek. Based on USGS water data, the flow rate of East Salt Creek is usually less than 1 cubic foot per second (cfs) with extremes of a maximum of 2,630 cfs on July 18, 1974, and a minimum of 0.08 cfs on March 30, 1975. Sheridan reported that the creek was completely dry during the summer of 1977. The tributaries to East Salt Creek, within the lease area, all exhibit emphemeral flow, flowing less than one month of each calendar year, usually in response to summer thunder storms. There are no available data on flow characteristics of these tributaries.

Sheridan estimates that they would require a flow rate of between 1 and 2 cfs (2 to 4 acre-feet per day). They currently own rights to pump a maximum of 10 cfs water from the Colorado River.

Ground Water

There is very little specific information on ground water availability for the area. However, the Rollins sandstone is located within the lower Mesaverde formation, which is the source of many springs and wells. The ground water flow in this formation is controlled by interstitial porosity, that is, water is contained and transmitted through interconnected pore spaces between grains within the sedimentary bedrock. Water yields from the formation vary between 0 and 50 gpm, but generally average 10 gpm.

A substantial quantity of unconfined water flows through the alluvial deposits along East Salt Creek. Sheridan has obtained data on the quality of this water but has not released the quantity of this flow. Water yields from the deeper Mesaverde aquifer could be as high as 50 gpm. However, the yield usually averages less than 10 gpm.

Water Quality

East Salt Creek has very poor quality water. Very high concentrations of sulfates, sodium, calcium, iron, dissolved solids, and total alkalinity were found. Table S2-2 gives the average of two sampling times, January 27, 1977 and May 7, 1977. The shallow ground water within the alluvium is very similar in quality to the surface water, with slight increases in dissolved solids, sodium, and hardness.

The quality of ground water in the Mesaverde group can generally be expected to be of poor quality. Analysis of water throughout this aquifer shows that excessive iron, manganese, sulfate, and fluoride are common and total dissolved solids are usually high, 1,000 to 3,000 milligrams per liter (Price and Waddell 1973, Price and Arnow 1974, and Brogdon and Giles 1977). Typically the water

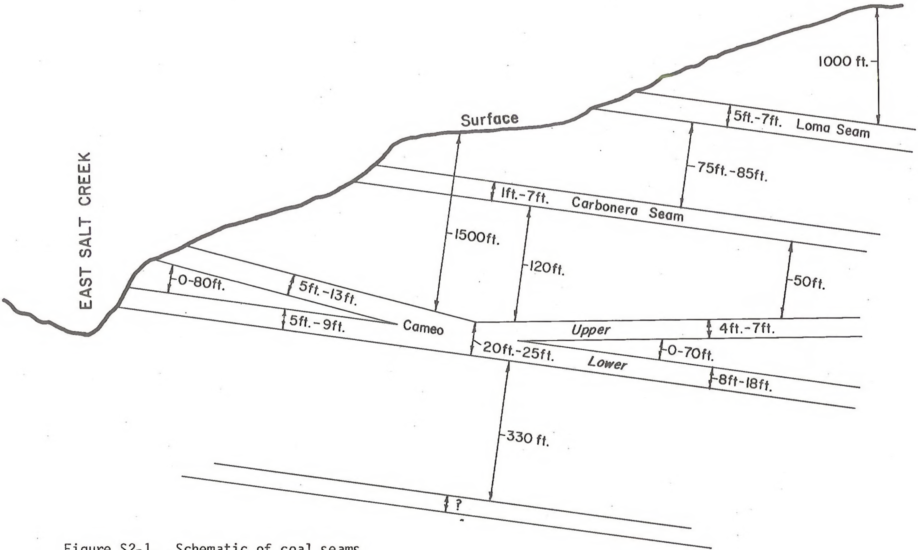


Figure S2-1. Schematic of coal seams at proposed Loma project

TABLE S2-1

SUMMARY OF FOSSIL-BEARING FORMATIONS IN THE AREA OF THE PROPOSED SHERIDAN MINE

Formation	Period	Known Fossil Localities a/	Type of Fossils b/
Mancos shale	Upper Cretaceous	General	V, I
Mt. Garfield	Upper Cretaceous	General	V, I, P
Hunter Canyon	Upper Cretaceous	General	V, I, P
Ohio Creek and Wasatch	Tertiary	General	V, I, P
Green River	Tertiary	General	V, I, P

a/ General = formation contains fossils throughout; specific localities are not identified.

b/ I = invertebrate; V = vertebrate; P = paleobotanical

is of poor chemical quality for domestic or public uses.

Soils

Soils in the areas of proposed surface disturbance are delineated in figure S2-2. In general, the area consists of shallow, poorly developed soils and rock outcrops on the steep lands bordering East Salt Creek and various side drainages. The flatter-lying soils in the drainage bottoms range from very gravelly or sandy components to much finer textured soils with excessive amounts of soluble salts. Specific soil features of importance in assessing reclamation are rated in table S2-3; brief explanations of each rating are contained in footnotes.

Vegetation

There is a mosaic of six vegetation types on the coal lease area: saltbush, pinyon-juniper, mountain shrub, greasewood, sagebrush, and riparian. Their distribution is largely determined by annual precipitation and the moisture content of the soil, which in turn are affected by other environmental factors, such as exposure and the nature of the substrate. (Map S2-1 shows the vegetation types in the lease tract.)

The saltbush type occurs at the south end of the lease tract, on dry, steep slopes that have a southern exposure. Pinyon-juniper is found on north slopes in this same area. It also occurs farther north, where it begins to appear on both north- and south-facing slopes. Mountain shrub replaces pinyon-juniper in the north end of the lease tract. It is first evident only on the north slopes; then at higher elevations it also begins to be found on southern exposures. This gradual transition of vegetation types results from increasing soil moisture content in the lease area from south to north and from lower to higher elevations. Vegetation types with low moisture requirements are replaced by types with higher moisture requirements.

The greasewood type is very limited in the coal lease area, occurring discontinuously along Salt and Spink creeks. Sagebrush also is found in the valleys of Salt and Spink creeks and on level mesas; both areas have deep, well-developed soils. The sagebrush and greasewood have been cleared on approximately 50 acres along Salt Creek and the lower part of Spink Creek. On Salt Creek, the land is now irrigated farmland; in Spink Canyon, the land is covered with annual weeds and grasses. Riparian vegetation along Salt Creek consists mainly of cottonwoods, running for the entire length of the lease tract. No data are available on aquatic vegetation in the area proposed for mining.

The land south of the lease area, between the Loma mine and the town of Loma, consists of saltbush or greasewood where it is publicly owned,

TABLE S2-2

WATER QUALITY ANALYSIS OF EAST SALT CREEK (1977)

Parameter	Concentration	Parameter	Concentration
ph	8.5 mg/l	Calcium	387 mg/l
Total Dissolved Solids	3,683 mg/l	Magnesium	385 mg/l
Total Hardness	1,062 mg/l	Chloride	30 mg/l
Total Alkalinity	609 mg/l	Sulfate	2,300 mg/l

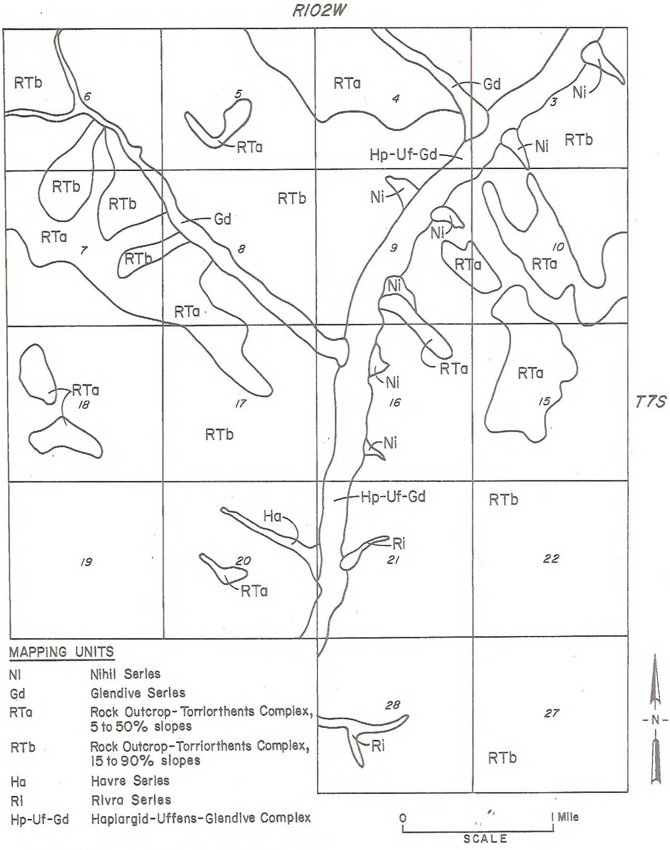


Figure S2-2. Soil units in area of the proposed Loma project

TABLE S2-3

SOIL FEATURES FOR SHERIDAN MINING AREA

Mapping Unit Symbol	Mapping Unit Name	Hydrologic Group a/	Erosion Hazard b/	Topsoil Rating c/	Reclamation Limitations d/
Gd	Glendive	B	Slight-moderate	Fair	Moderate
Ha	Havre	B	Moderate	Fair	Moderate
Hp-Uf-Gd	Haplargid-Uffens-Glendive Complex				
	Haplargid	C	Slight-Moderate	Fair	Moderate
	Uffens	D	Slight-Moderate	Poor	Severe
	Glendive	B	Slight-Moderate	Fair	Moderate
Ni	Nihill	B	Slight-Moderate	Poor	Severe
Ri	Rivra	A	Slight	Poor	Severe
RTa	Rock Outcrop-Torriorthents Complex 5-50% slopes	-	High	Poor	Severe
RTb	Rock Outcrop-Torriorthents Complex 15-90% slopes	-	High	Poor	Severe

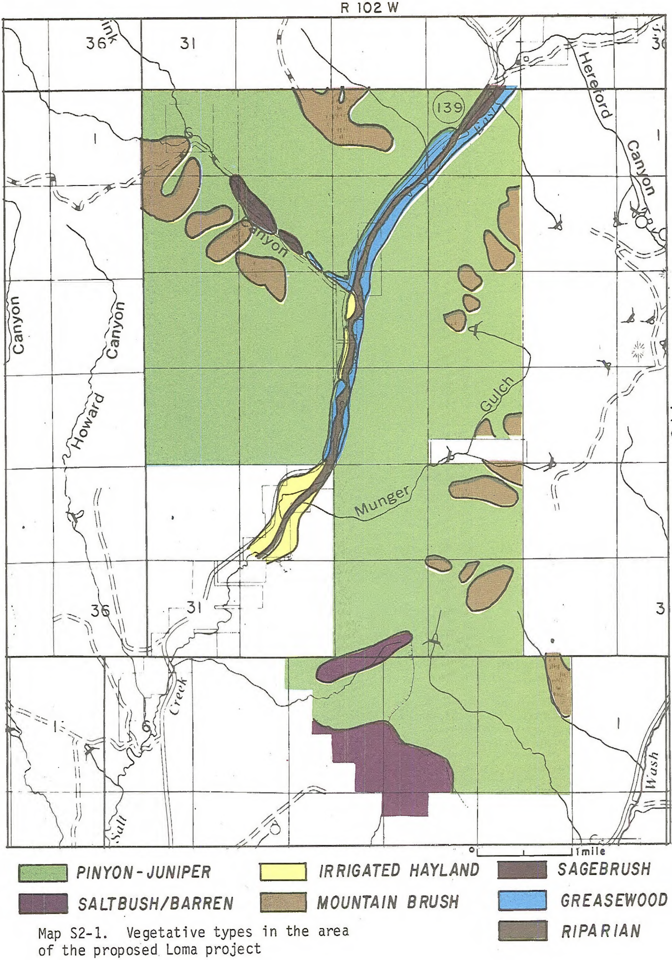
Source: Adapted from data provided by U.S. Department of Agriculture, Soil Conservation Service, Grand Junction, Colorado.

a/ Hydrologic soil groups (A, B, C, D) are based on the rate at which water enters the soil surface (infiltration) and the rate at which water moves within the soil (transmission). When both infiltration and transmission rates are high, little surface runoff occurs (Hydrologic Soil Group A). In contrast, low infiltration and transmission rates produce high surface runoff (Hydrologic Soil Group D). Groups B and C are intermediate.

b/ Erosion hazard refers to the potential for surface soil loss when existing cover is removed or seriously disturbed.

c/ Topsoil is rated both on suitability as a seedbed material and on ability to sustain plant growth. Factors considered include soil depth, texture, amount of coarse fragments, and the presence of excess soluble salts which may inhibit plant growth.

d/ Hydrologic soil groups, erosion hazard, and topsoil rating, along with climatic information, are considered jointly to determine an overall rating of the limitations for reclamation. Specific degrees of limitation are interpreted as follows: Slight - indicates either no significant limitations or those limitations which can be remedied through planning and management choices, such as species selection, time of seeding, or short-term exclusion of livestock and certain forms of wildlife. Moderate - indicates significant limitations which must be recognized but which generally can be overcome through established measures to conserve natural moisture, reduce erosion, and augment available nutrient supplies. Severe - indicates serious deficiencies in natural moisture and in the amount and quality of topsoil; may also indicate topographic conditions which produce extreme surface erosion or landslide hazards.



Map S2-1. Vegetative types in the area of the proposed Loma project

and of agricultural land where it is privately owned.

A more detailed discussion of the plant species composition of these vegetation types, as well as their relationship to climatic and topographic features and to each other can be found in the regional analysis. Scientific names of the plants discussed above are listed in appendix B.

Endangered or Threatened Species

Information on the location of plants within the region that are proposed to be officially listed as endangered or threatened in the *Federal Register* (see table R2-10 in the regional chapter 2 for a list of the plants) was obtained from detailed literature searches (Rollins 1941; Barneby 1964; Higgins 1971; Hitchcock 1950; Arp 1972, 1973; Reveal 1969; Keck 1937; Howell 1944; Benson 1961, 1962, 1966; Weber 1961) and extensive herbarium surveys (University of Colorado, Colorado State University, Colorado College, Denver Botanic Gardens, Western State College, Rocky Mountain Biological Lab, Black Canyon National Monument, Colorado National Monument, and Grand Mesa/ Uncompahgre National Forest Headquarters). This research has revealed that none of the plants is known to have occurred historically in the area of the Loma Mine. The results of the literature and herbarium studies may be seen at the BLM's Montrose District Office. A detailed floristic and endangered and threatened plant inventory of the natural vegetation that is expected to be disturbed by the Loma mine facilities and roads has revealed that no endangered or threatened plants are present. The results of this inventory are available for public review at the Grand Junction District Office.

Terrestrial Wildlife

All terrestrial species known or expected to occur on the East Salt Creek drainage and on the desert and farmland to the south are listed in appendix C.

Big Game

Mule Deer

The entire Sheridan lease area is mule deer winter range. Deer summer in the Douglas Pass area to the north, migrate during November and December in a southerly direction to lower elevations, and remain there through the winter months. Lower limits of the winter range extend to the base of the Little Bookcliffs and include the lower end of East Salt Creek, Howard Canyon, and East Branch (map S2-2), which is an area where deer concentrate. Major habitats utilized by deer are pinyon-juniper types on canyon sides and sagebrush and greasewood types in the drainage bottoms. Pellet group transects indicate an average of 42 deer days of use per acre in the area near the lease tracts.

The irrigated alfalfa fields are also important in this area. Deer use them most heavily in the early spring when the fields are just beginning to green up, although a few deer occur around the fields yearlong.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average numbers. Mule deer winter populations have been estimated at about 50 deer per square mile. This would indicate a total deer popula ation within the Sheridan lease area of about 700 animals during the winter months. In recent years, deer populations have been stable but greatly reduced from the 1960s.

Antelope

In the early 1960s, the Colorado Division of Wildlife (DOW) released 50 antelope in the desert country north of the Highline Canal. In recent years, the population has been stable; present population is estimated at 35 to 50 animals. Current distribution is shown on map S2- 2.

Elk

In recent years, several small groups of elk have spent the winter in the upper reaches of East Salt Creek. Occurrence of elk in this area is sporadic, and the number of animals is very small.

Mountain Lion

The Little Bookcliffs support one of the highest populations of mountain lion in western Colorado. The DOW estimates that Game Management Unit 30 (see Recreation) supports a population of approximately 40 lions. Occupied habitat (shown on map S2-2) corresponds to mule deer habitat, and seasonal movements of mule deer influence lion distribution. The rough broken topography, pinyon-juniper and oakbrush vegetation, and mule deer population provide the essential habitat components of cover, food, and isolated living space preferred by mountain lions.

Black Bear

Black bear are found above 7,000 feet in the mountain shrub, aspen, and spruce-fir types. During the spring and fall, black bear occasionally venture into the pinyon-juniper habitat type below 7,000 feet in search of food. The upper (northern) portions of Sheridan's lease is occupied black bear habitat (map S2-2).

Small Mammals

Mammal species present are typical of the saltbush, sagebrush, mountain shrub, and pinyon-juniper habitat types in western Colorado. Species

common within the Little Bookcliffs include cottontail rabbit, rock squirrel, deer mouse, white-tailed antelope squirrel, coyote, and bobcat. On the desert between the Little Bookcliffs and the Highline Canal, white-tailed prairie dog colonies are common. Location of towns and number of burrows can be found in prairie dog inventories on file in the Grand Junction District Office of the BLM.

Game Birds

Mourning doves are the most common game birds occurring throughout the Little Bookcliffs area. Doves arrive in the spring, nest through the summer months, and begin migrating to the south by late August.

Chukar, a species introduced in the 1950s, has become established throughout the lower canyons and rocky slopes of the Little Bookcliffs. During the summer, birds are concentrated within 1 or 2 miles of areas with available water; at other times of the year, the birds are widely dispersed.

Blue grouse are found at higher elevations in the Little Bookcliffs. They utilize mountain shrub, aspen, and spruce-fir habitat types. Within the agricultural areas, pheasant and gambel quail have been introduced.

Waterfowl utilize the Colorado River, farm ponds, and several nearby larger reservoirs for nesting. During the spring and fall, large numbers of migrating birds can be found nesting and feeding on practically all water bodies in the area. Agricultural lands provide food for mallards and Canada geese through the winter. The Colorado River and Highline Lake are primary waterfowl resting areas through the winter, particularly after smaller water bodies have frozen up.

Other Birds

A raptor inventory conducted in 1977 identified seven active and three suspected golden eagle aeries and eight active and six suspected prairie falcon aeries on the main face of the Little Bookcliffs from the Colorado state line to DeBeque Canyon (Enderson 1977). The sheer faces of the Little Bookcliffs and the large expanse of open country between the base of the cliffs and the Highline Canal provide some of the most productive nesting and hunting habitat for these two species in western Colorado (See map S2-2.).

A wide variety of nongame birds occurs throughout the various habitat types and seasons. During spring migration, greater sandhill cranes pass through western Colorado. Cranes have been observed stopping over in the vicinity of Highline Lake and along East Salt Wash in the open desert area.

East Salt Creek is a focal point of wildlife activity during much of the year on the desert area between the Highline Canal and the Little Bookcliffs. Although East Salt Creek is not a perennial stream, water is often available along the wash after other waterholes on the desert have dried up. The cottonwood trees and limited amount of other riparian vegetation provide unique habitat that attracts many small birds and mammals.

Amphibians and Reptiles

Common amphibians, such as Rocky Mountain toad, the red-backed toad, and the leopard frog, and common reptiles, such as the collared lizard, the sagebrush lizard, the gopher snake, and the wandering garter snake, have been found within the Grand Valley (Thorne Ecological Institute 1976).

A subspecies of the prairie rattlesnake, the midget-faded rattlesnake, is worth mentioning because of its apparent rarity in the region. Although the snake is not officially designated as threatened or endangered, few specimens are reported from Colorado. It does occur in the Little Bookcliffs and out into the desert floor.

Threatened and Endangered Species

The desert floor between the base of the Little Bookcliffs and the Highline Canal currently supports a population of white-tailed prairie dogs. These animals provide the necessary habitat requirement for the black-footed ferret, which is thought to have occurred historically in the area. A BLM management objective is to maintain a prairie-dog population for the eventual reintroduction of ferret.

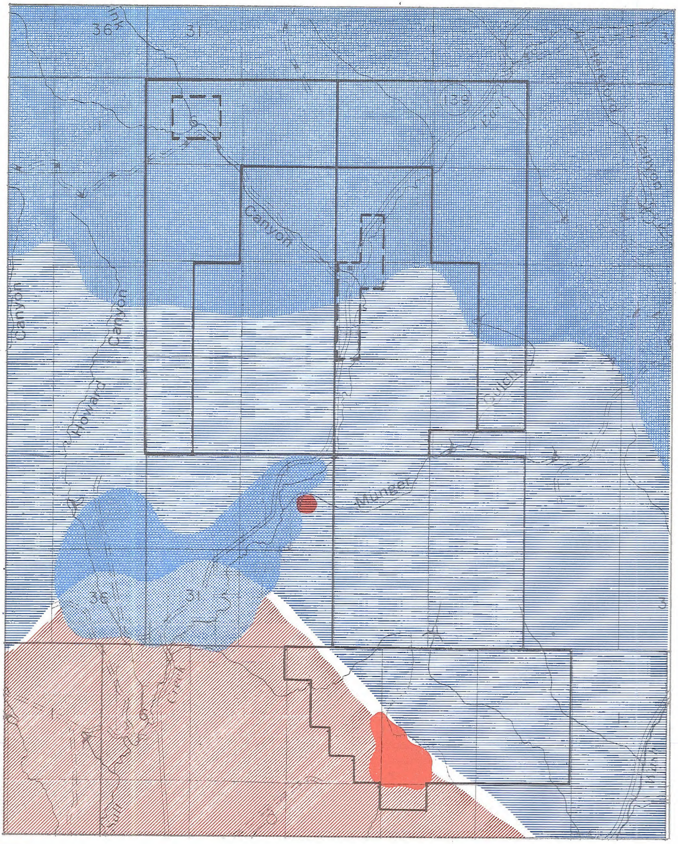
Bald eagles spend the winter along the Colorado River feeding on waterfowl and fish. Highline Lake and surrounding agricultural lands also attract bald eagles because waterfowl and carrion are available food sources.

Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act of 1973 and the Bald and Golden Eagle Protection Act (16 USC 668-668d) will be initiated and completed prior to authorization of any action that may affect a listed species or a golden eagle.

Aquatic Biology

Approximately 6 miles of the headwaters of East Salt Creek are within the Sheridan lease site. About 90 percent of the channel is publicly owned.

The drainage area and tributaries forming East Salt Creek receive very little precipitation and the stream flow is usually less than 1 cfs. During a short period of spring snowmelt and during severe thunderstorms stream flows rise rapidly. Water quality is naturally poor because of the highly erosive type of drainage. Runoff is typically very high in sulfates, chlorides, total dissolved soilds, and suspended sediments. No significant aquatic life is



ANTELOPE YEARLONG RANGE

RAPTOR NEST HABITAT

BLACK BEAR YEARLONG RANGE

MULE DEER WINTER RANGE

MULE DEER CRUCIAL AREA

Map S2-2. Wildlife ranges in the area of the proposed Loma project: deer, antelope, bear, raptors

present in any of the tributaries on the Sheridan lease site.

The mining site is approximately 20 miles from the Colorado River, and all site drainage would reach the river during a precipitation event. The Colorado River at this location is considered a warm water fishery. Channel catfish, largemouth bass, sunfish and bullheads dominate the gamefish population while numerous nongame fish species including roundtail chub, sand shiner, carp, flannelmouth sucker, bluehead sucker, speckled dace, redfin shiner, carp, and others are found here.

Endangered or Threatened Species

From below the confluence of Plateau Creek this section of the Colorado River is habitat for three species of threatened and endangered fish. The Colorado squawfish, the razorback sucker, and the humpback chub are presently known to exist in the river. The U.S. Fish and Wildlife Service has recommended this section of river as critical habitat for the Colorado squawfish (see Aquatic Biology, chapter 2, regional analysis).

Cultural Resources

Archeological Resources

Several inventories have been completed for drill holes and access roads (Connor 1975, 1977). No archeological resources were located. A Class III survey is required prior to approval of the proposed action.

Petroglyph AR-05-07-382 is located within the lease area. This site includes a Ute style panel of mud-painted horse and rider and hunted animal. In addition, there are historic panels with names, dates, and female and animal figures.

As part of the regional predictability model sample (see appendix D), archeological surveys in areas near the Sheridan mine site indicate a probable site density of 0.25 site per section (Hibbets 1978). Until the predictability model is completed, however, no conclusive statement can be made concerning its applicability to archeological resources in the lease area; the final report is due December 15, 1978. The presence of petroglyph AR-05-07-382 and the domination of pinyon-juniper in the lease area (see map S2-1, vegetation types in the Sheridan lease area) suggests use of the area as part of a seasonal exploitation pattern.

Historic Resources

Limited cultural resource surveys (Buckles 1975 and Connor 1977) have been conducted on specific test holes and access roads at this site. A mine dating from 1938 was recorded, but it does not appear to have any historic significance. Other areas that would be directly impacted will be surveyed prior to surface disturbance.

Transportation

Highways

The proposed Sheridan mines would be located close to State Highway 139, the Douglas Pass road, which connects Loma and Rangely. The road is paved and capable of handling increased traffic. In 1976, average daily traffic at Douglas Pass was 500 vehicles.

Railroads

There is no direct rail line to or near the Sheridan mines. The closest rail line is the Denver and Rio Grande Western main line at Loma.

Airports

Walker Field at Grand Junction is the closest airport to the proposed operation. This is the major airport in western Colorado and is served on a regular basis by Frontier and United Airlines.

Livestock

The Sheridan coal lease tract is part of three BLM grazing allotments: the Garr Mesa, East Salt Creek, and Big Salt allotments (see table S2-4 for acreages, AUMs, class of livestock, and season of use for each allotment, and map S2-3 for allotment boundaries). There are a number of range improvements within the lease area: four stock reservoirs, three cattleguards, approximately 6 miles of fence, and 7 miles of stock trail.

Recreation

There are no recreational facilities on the Sheridan lease site. However, the canyons of the lease site provide wintering grounds for mule deer as well as habitat for various species of small game, including chukar. (Refer to Wildlife in this chapter for the extent of the resource.) The lease site is located within Big Game Management Unit 30, which provided 3,364 recreation days in 1976, and Small Game Management Unit 58, which provided 35,723 recreation days in 1975. (Tables S2-5 and S2-6 list recreation days by hunters, species, and game management units.) The streams on the lease site are intermittent and provide no fisheries. (Refer to Aquatic Biology in this chapter.)

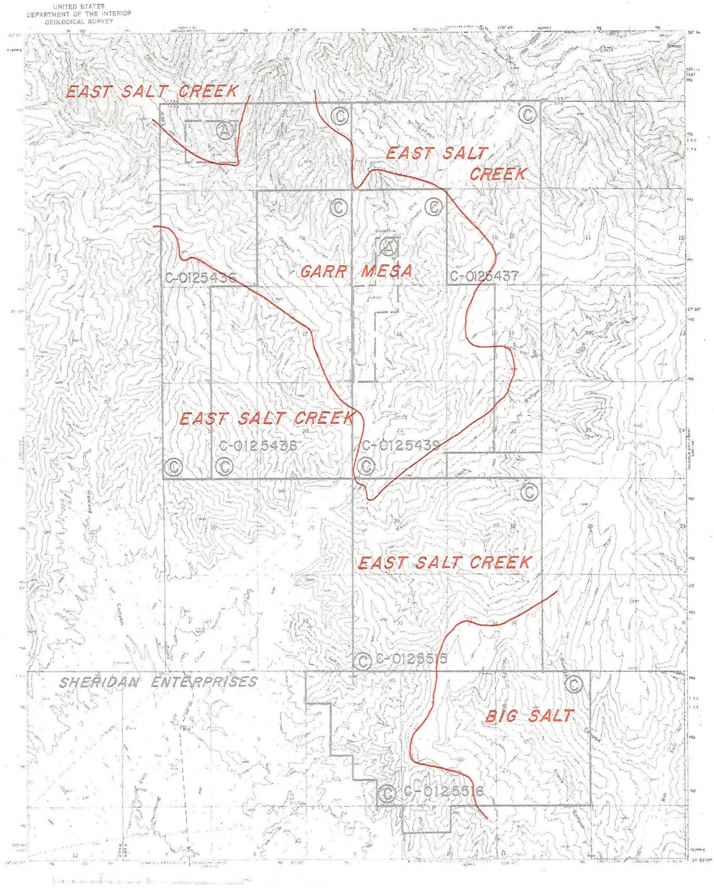
State Highway 139 passes through the lease site in a general north- south direction. This highway is a major route to Dinosaur National Monument and the scenic Douglas Pass area. Traffic on the highway averaged 500 vehicles per day in 1976. The portion of this volume which can be attributed to recreation is not known. ('Colorado State Department of Highways, Traffic Volume Study 1976'.)

Most of the population increase due to mining at the lease site would occur in the Grand Junction-Fruita area, where a wide range of recreation op-

TABLE S2-4

ALLOTMENTS AND LIVESTOCK USE WITHIN
SHERIDAN COAL LEASE TRACT

Allotment	Acres Within Coal Lease Tract	Animal Unit Months (AUM) of Forage Within Coal Lease Tract	Acres Per AUM	Class of Livestock	Season of Use
East Salt Allotment	8,298	901	9.2	Cattle Horses	03/01 to 02/29 cattle (yearlong) 06/01 to 02/29
Garr Mesa Allotment	4,762	553	8.6	Cattle	05/01 to 05/31 10/01 to 12/02
Big Salt Allotment	1,875	84	22.3	Cattle	03/01 to 02/28 (yearlong)



Map S2-3. Garr Mesa, East Salt Creek, and Big Salt livestock grazing allotment boundaries

TABLE S2-5

BIG GAME HUNTING IN BIG GAME MANAGEMENT UNIT 30

	Deer	Elk	Bear	Mountain Lion	Total
Hunters	854	-	20	9	a/
Recreation days b/	3,122	-	151	91	3,364

Source: Colorado Division of Wildlife, 1976 Colorado Big Game Harvest.

a/ Hunter totals are not provided because hunting and trapping of more than one species are not allowed.

b/ All or part of a day.

TABLE S2-6

SMALL GAME HUNTING AND TRAPPING IN SMALL GAME MANAGEMENT UNIT 58

Animal	Hunters	Recreation Days a/	Animal	Trappers	Recreation Days a/
Ducks	1,166	9,794	Badgers	9	757
Geese	423	1,950	Beavers	17	426
Doves and pigeons	1,106	6,251	Bobcats	30	1,918
Pheasants	2,021	7,203	Ringtailed cats	3	310
Chukars	500	1,123	Coyotes	21	2,086
Grouses	261	814	Foxes	29	1,235
Ptarmigans	7	0	Muskrats	32	1,203
Rabbits	3,952	28,789	Raccoons	20	509
Squirrels	53	225	Skunks	7	144
Foxes	38	72			
Coyotes	386	4,529			
Marmots	98	299			
Prairie dogs	550	4,140			
Magpies	352	5,283			
Total	b/	70,472		b/	8,588

Source: Colorado Division of Wildlife, 1975 Colorado Small Game, Furbearer, Varmint Harvest.

a/ All or part of a day.

b/ Hunter totals are not included because hunting and trapping of more than one species are allowed.

portunities exist. Grand Junction has city-sponsored leagues for softball, basketball, and volleyball. Facilities include eleven parks, fourteen swimming pools, and sixteen tennis courts. The Grand Junction Recreation Department feels that use of its facilities is now maximum; people have to be turned away from the programs, especially league activities. The department also states that only 40 percent of this use is by city residents, which indicates that the city's programs are a major recreation outlet for the surrounding area. Fruita provides leagues for softball and football and has three parks and a pool.

For a comprehensive look at the recreational resources of the area, refer to chapter 2 of the regional analysis, Recreation.

Visual Resources

East Salt Creek

The 500-foot-wide East Salt Creek Valley is confined by steeply sloping hills and cliffs that range from 800 feet to more than 1,000 feet above the valley. The U-shaped valley narrows toward its north end, becoming V-shaped. Any long view of the valley is restricted by the adjoining hills; instead, the viewer moves through a sequence of smaller, apparently separate vistas, finding elements such as unexpected geologic formations in one vista but not in the next.

The side slopes expose horizontal stratifications which establish a linear component in the composition of the valley landform. Rock overhangs create shadow patterns; combined with the different rock colors, they emphasize the linear, horizontal pattern in the side slopes.

The side-hill cover is a sparse mixture of pinyon and juniper, which gives these slopes a spotty texture (see figure S2-3). The tan hues of the exposed rock and soil are a light background, which contrasts strongly with the darker juniper trees and other landscape components, further defining the vegetative texture of this landscape.

Grasses and shrubs cover the flatter valley floor with a more continuous surface, but the irrigated lands interrupt this native vegetation. Riparian vegetation along East Salt Creek follows the valley alignment, and this ribbon of vegetation is emphasized by the seasonal color changes of deciduous trees. An edge condition is created along the valley floor where the habitat boundaries of the plant communities reinforce the bottom-land and side-slope boundary.

Highway 139 follows the curves and bends of the valley, and this linear pattern is duplicated by adjoining fence lines. The irrigation channels and the isolated cabins, outbuildings, corrals, and fences are normally perceived as embellishments to the landscape rather than undesirable intrusions.

Spink Canyon, Munger Canyon, McLane Canyon, and an unnamed canyon that Sheridan would use for refuse disposal all drain into East Salt Creek. Each has a unique character formed by a specific combination of landform, vegetation, and human modification.

Spink Canyon

Spink Canyon is a relatively undisturbed, narrow, U-shaped formation with exposed rock outcrops. Pinyon-juniper vegetation partially covers the side slopes; it is denser in the drainage courses. Grasses, sages, and shrubs dominate the valley floor cover and establish intermittent open and rough surface textures.

A dirt road winds through the valley to a trail junction. It is fenced off at the Highway 139 junction, preventing access to the casual viewer.

Munger Canyon

Munger Canyon is a narrow, deep, V-shaped drainage, which has minimal flatland along the bottom. Sparse vegetation and some rock outcrops occur on the side slopes, but the steep slopes are the primary element of the canyon.

Exploratory mining in the eastern portion of the canyon has altered the south slope. The single-lane road has left cut-and-fill scars on the side slope; terraces at the portal location are additional landform alterations that detract from the natural appearance of the canyon.

McLane Canyon

Cliffs and steep taluses along the McLane drainage create a dramatic canyon landscape. The cliff faces display horizontal cleavage lines, overhangs, and terrace features. Juniper bushes are sparsely scattered on the slopes along with grasses, sage, etc., but the vegetation remains visually subordinate to the landform.

Other than a recently bulldozed road paralleling a deep erosion channel, there are few human alterations evident until the eastern portion of the canyon, which terminates in a semicircle of cliffs. Mine portals and ventilation and exploration shafts penetrate the exposed coal seam and have bulldozed terraces at their entrances. These alterations have leveled the limited ground space and show no evidence of revegetation.

Refuse Canyon

The valley that is directly west of McLane Canyon would be used for refuse disposal. The valley is approximately 300 feet wide and flat at the East Salt Creek end, but narrows within a mile. The north slope of the valley is well marked by terraces, rock outcrops, and cliffs, while the south slope is gently rippled by rounded drainage depressions. Horizontal lines are moderately evident on the north slope, while lateral lines caused by vege-

Figure S2-3. The steeply sloping hills of East Salt Creek Valley are covered with a sparse mixture of pinyon and juniper.

tation changes follow the drainages across the south slope.

The pinyon-juniper vegetation establishes a continuous green texture on the southern slope until it intermingles with the grass and forb cover of the valley bottom. The texture change and the 'edge' boundary are difinitive visual elements of the landscape.

Railroad Right-of-way

Alluvial bottomlands with moderate terraces characterize the landform between Mack and the proposed central facility site along East Salt Creek. Light buff and gray soil colors form a continuous hue which is only broken by some darker soil colors in the irrigated fields. The mixed vegetation cover of native grasses and cultivated crops accentuates the topography by the darker, irrigated field patterns following the valley bottoms; the lighter, native grasses grow on the side slopes and terrace tops.

The natural valley landscape has been modified by many human altera tions for varying land uses. Agricultural utilization has created fields, access roads, irrigation and fence lines; power and telephone lines follow the road corridors to the scattered residences in the area. The visual influence of the alterations on the natural landscape has been the development of a pastoral landscape character in this portion of the Grand Valley.

VRM Classifications

The inherent scenic quality of the East Salt Creek Valley has been rated (see appendix F) as a 'B,' which represents a diversity of landform, vegetation, and colors. The undeveloped status of the area and the moderate sensitivity level of Route 139 (450 vehicles per day in 1976) have resulted in a VRM Class II rating (see appendix F). According to the visual planning objective of this rating, human modifications of the landscape's form, line, color, and texture should not be evident on the characteristic landscape. The existing, natural landscape character is a relatively undeveloped valley that offers recreational landscape viewing and sequential vistas of rock escarpments, small ranching operations, and native vegetation.

The East Salt Creek VRM Class II overlaps into the adjacent canyons. Beyond the areas that are visible from Route 139, however, the VRM class changes to a IV, because fewer people see these canyons. The Class IV designation specifies that landscape changes may dominate the original landscape composition but that these changes should reflect what could be a natural occurrence.

Socioeconomic Conditions

Demography

Although the Sheridan site is in Garfield County, the nearest population centers are in Mesa County. Table S2-7 lists the population for each incorporated town and each county census area within Mesa County, for the 1970 and 1977 censuses. The table indicates that most areas around Grand Junction have grown at a moderate rate, averaging between 3 and 5 percent per year since 1970.

The median age of the population in Mesa County is higher, but not significantly higher, than the Colorado median age of 26.2 years. The Palisade area has a relatively older population than the rest of the county, and a much higher concentration of persons over 65 years of age.

Grand Junction and vicinity is the most heavily populated community between the Denver and Salt Lake City metropolitan areas. As such, it serves as a regional center of commercial and industrial activity for most of western Colorado and eastern Utah. Recent growth in the Grand Junction area has been caused by a variety of economic factors, including the expectation that the area's mineral resources will develop rapidly. Corporations and government agencies involved in mineral resource development over a wide area have located regional headquarters in Grand Junction.

Community Attitudes and Lifestyle

According to the Mesa County Development Department, a majority of the new residents in the Grand Junction area moved there because they liked it as a place to live. The Grand Junction area is more urban than most other areas of western Colorado, but it is still small enough to retain attributes of small town living. Residents place a high value on the casual atmosphere and lack of congestion associated with life in Grand Junction. However, there is also a desire to attract economic growth to the area and improve job opportunities for residents.

As a population center, Grand Junction provides its residents opportunities not available in most other communities in western Colorado. Mesa College offers courses of study in many subject areas, college athletic events, and dramatic performances. There is a larger selection of stores, restaurants, and movie theatres than in other towns. Airline and bus service to metropolitan areas is regularly available, and an interstate highway links Grand Junction to Denver and Salt Lake City.

Community attitudes towards growth and development were documented in a survey conducted by Bickert, Brown, and Coddington and Associates, Inc., in July 1973. Results of that survey are discussed in the regional volume.

Community Facilties

Most of the developed areas around Grand Junction receive water from the Ute Water Conservancy District which provides water to other districts and to individuals. The district is currently developing additional water resources. There are many special districts in the county providing various services including water, sewer, fire protection, pest control, hospital services, cemetery services, and flood control. There are two sanitary land fills in the county. Police service outside of town is provided by the county sheriff.

Grand Junction, Fruita, Collbran, Palisade, and DeBeque are improving or plan to improve their water and sewage treatment systems. More detailed information about facilities in the county is included in the regional volume.

Housing

The Colorado Division of Housing estimates that there was a total of 24,914 housing units in Mesa County in April 1976, an increase of 6,116 units (or 32 percent) from 1970. Over one-third of the total increase in housing stock was mobile home units. In recent years, duplexes and multi-family units have constituted about 30 percent of the new housing starts. (Table S2-8 lists the total number of housing units in each of the incorporated areas of the county as counted in the 1977 special population census.) High prices for single-family dwellings and the unavailability of rental units are contributing to an increase in multi- family and mobile home units throughout the county. The county has an above average need for low to moderate income housing, because (1) the median family income is more than $3,000 less than the state median and (2) Mesa County has an above average number of elderly persons.

Education

The Mesa County Valley School District 51 provides public education to most of Mesa County, excluding the DeBeque and Collbran areas. District 51 operates 24 elementary schools, 6 junior high schools, 4 high schools, 2 vocational schools, and an occupational school. The average daily membership was 13,233 in the 1975-76 school year. Even though total population has steadily increased in the area, enrollment was slightly lower in 1975-1976 than in 1970-1971, which reflects the national trend in decreasing school enrollments.

Table S2-9 shows that the school district has some excess capacity in existing schools. The schools which have the most limited capacity are the junior high schools. The district is presently considering a new bond issue to finance some remodeling and the construction of two new elementary schools, a new junior high school, a vocational-technical building, and a special education building. The total cost of this work is estimated to be $14 million.

The district presently has about $2.5 million in outstanding debt from two previous bond issues. Total outstanding debt is due to be retired in 1981 from property tax collections.

The district's total mill levy of 45.68 mills is about 5 mills higher than the average for districts across the state. The authorized revenue base per pupil for the district, which is set by the state, is about $200 less than the state average.

The district has a staff of 678 teachers, or a student-teacher ratio of 20 to 1. Teachers' salaries vary from $8,500 to $17,270. The district also has special education programs for the deaf, blind, emotionally disturbed, and mentally handicapped.

Health Care

The level of health care services in and around Grand Junction is the highest in the ES area. The four hospitals located in Grand Junction provide specialized services to much of western Colorado. In addition, the Fruita area is served by a small hospital located in town. There are more physicians located in Grand Junction than in the remainder of the ES area combined. Many of these physicians are specialists, who provide their services to patients from a wide area. Ambulance services to the area is good; both Fruita and Grand Junction operate ambulance services connected with their fire deparments.

Mental health services are provided to the area by the Colorado West Regional Mental Health Center, which is headquartered at Glenwood Springs but has offices in Grand Junction.

The Mesa County Department of Public Health has a staff of six public health nurses who provide generalized health education and preventative health services in addition to specialized activities in tuberculosis control, mental retardation, venereal disease, and handicapped children's programs.

Employment

In Mesa County, where virtually all of Sheridan's employees would live, employment grew at an annual rate of 6.1 percent between 1973 and 1976. The total number of persons employed increased from 24,030 to 28,622 during this period. As shown in table S2-10, the increase was all in nonagricultural employment; agricultural employment declined by 11.6 percent. A comparison of employment by sector shows that all sectors showed some growth, but the mining, the transportation, the finance, insurance, and real estate, and the contract construction sectors had the largest percentage increases. The increase of 130 percent in mining employment can be attributed to new mining activity in the Uravan uranium belt and

TABLE S2-7

POPULATION STATISTICS

Area	1970 Population	1977 Population	Percent Change 1970-1977	Median Age 1970 (Years)	Median Age 1977 (Years)	Percent Population Over 65 Years
Mesa County	54,374	66,848	+23	30.2	29.4	+11
Clifton Area	3,554	5,913	+66	30.2	26.8	+ 9
Fruita	1,822	2,328	+28	34.1	28.5	+15
Fruita Area	5,837	7,709	+32	29.4	28.4	+10
Grand Junction	24,043	25,398	+ 5	32.1	30.2	+15
Grand Junction Area	28,527	35,871	+26	30.0	29.3	+13
Orchard Mesa Area	6,890	5,012	-27	28.6	29.6	+ 8
Palisade	874	1,038	+19	--	46.9	+31
Palisade Area	1,964	2,178	+10	41.8	38.8	+21
Redlands Area	4,446	6,826	+53	29.9	30.6	+ 6
Whitewater Area	605	751	+24	36.1	32.6	+12

TABLE S2-8

EXISTING HOUSING IN MESA COUNTY

Town	Total Housing Units Occupied	Total Housing Units Vacant
Collbran	119	13
DeBeque	100	11
Fruita	788	41
Grand Junction	10,129	596
Palisade	418	23
Unincorporated areas	12,321	759

Source: U.S. Bureau of the Census, Special Population Census for Mesa County, 1977.

TABLE S2-9

MESA COUNTY VALLEY SCHOOL DISTRICT
SCHOOL CAPACITIES

	1977 Enrollment	Design Capacity	Excess Capacity
Elementary Schools			
Appleton	255	330	75
Broadway	653	630	- 23
Chatfield	381	420	(Expanding to 620)
Clifton	534	630	96
Columbine	419	420	1
Columbus	440	420	- 20
Fruita	340	350	10
Fruitvale	514	550	36
Gateway	32	75	43
Lincoln, Orchard Mesa	545	570	25
Lincoln Park	335	400	65
Loma	186	200	14
Nisley	432	475	43
Orchard Avenue	343	420	77
Pomona	369	420	51
Riverside	59	96	37
Scenic	403	420	17
Shellady	233	240	17
Taylor	355	420	65
Tope	380	420	40
Subtotal	7,208	8,106	898
Junior High Schools			
Bookcliff	752	700	- 52
East	588	625	37
Fruita	784	750	- 34
Gateway (Jr. & Sr. High)	25	30	5
Orchard Mesa	663	725	62
West	577	625	48
Subtotal	3,389	3,455	66
High Schools			
Central	911	1,100	189
Fruita Monument	838	1,000	162
Grand Junction	1,252	1,400	148
Palisade (Jr. & Sr. High)	427	500	73
Subtotal	3,428	4,000	572
Total	14,025	15,561	1,536

Source: Mesa County Valley School District, November 9, 1977.

TABLE S2-10

GROWTH OF EMPLOYMENT BY SECTOR
IN MESA COUNTY, 1973-1976

Sector	1973	1976	Increase	Percent Change
Agriculture	3,030	1,790	- 240	- 11.8
Mining	390	900	+ 510	+ 130.8
Contract Construction	1,330	1,730	+ 400	+ 30.1
Manufacturing	2,280	2,440	+ 160	+ 7.0
Transportation	1,420	1,680	+ 460	+ 32.4
Wholesale and Retail Trade	5,040	5,710	+ 670	+ 13.3
Finance, Insurance, and Real Estate	630	820	+ 190	+ 30.2
Service	3,420	4,410	+ 990	+ 28.9
Government	4,140	4,470	+ 330	+ 8.0

Source: Colorado Division of Employment, Research and Analysis, February 1977.

Note: This information does not include self-employed workers, other than in agriculture, unpaid family, and domestic workers.

coal mining in western Garfield County. Oil shale test projects near DeBeque and Grand Valley have also added to employment in the mining sector. In terms of number of employees, the service trade and mining sectors showed the greatest increase.

Table S2-10 also shows that the trade, service, and government sectors are the largest employers in the Mesa County economy and that, in spite of the fast growth rate, the finance, insurance, and real estate sector and the mining sector are the smallest. The sectors with the largest employment in Garfield County are also trade, services, and government. Almost all sectors have grown since 1970.

The regional volume gives more detail about employment in Mesa and Garfield counties. Employment data for specific towns and cities are not available.

Income

There are no towns in Garfield County near the proposed Sheridan site, which is on the Douglas Pass road north of Loma. Any growth because of this project could be expected to occur in Mesa County.

The 1974 per capita income in both Garfield and Mesa counties was lower than the Colorado state average of $5,514, but Garfield County at $5,106 was higher than Mesa County at $4,799. More information about incomes in the counties and the area may be found in the regional volume, chapter 2, Socioeconomic Conditions.

FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

The following sections describe the possible future environment by 1990 if the action proposed in chapter 1 is not implemented. They deal only with the resources or land uses described in the preceding sections of chapter 2 which are expected to change in the future: vegetation, wildlife, archeological resources, livestock, recreation, visual resources, and socioeconomic conditions.

Vegetation

Without the proposed action, the primary use of the vegetation would remain livestock and wildlife forage. If the AMP is implemented on the Garr Mesa allotment (see Livestock), vegetative condition may improve due to an increase in density of the key species (galleta grass, Indian ricegrass, Colorado wildrye, and western wheatgrass). A decrease in the hedging of serviceberry would also be expected.

Wildlife

Habitat conditions should improve due to implementation of the Garr Mesa Allotment Management Plan (see Livestock).

Archeological Resources

Through the year 1990, vandalism and erosion would be the two major factors causing the loss of archeological values. It is doubtful that additional monies or employees would be available to retard this loss, although the Federal Land Policy and Management Act of 1976 will provide BLM with more protective enforcement authority. The downward trend is expected to continue or accelerate under the present land use management program.

Livestock

Two stock reservoirs, three cattleguards, and approximately 0.5 mile of fence are proposed to be constructed in the coal lease tract, regardless of the proposed action.

The implementation of a new allotment management plan (AMP) for the Garr Mesa allotment will be considered in the upcoming Grand Junction Grazing Environmental Statement (no publication date set at the present time). If the AMP is approved, the part of the Garr Mesa allotment within the coal lease tract would be placed in a two-pasture cycle of spring and fall use one year, and fall use the next year.

Recreation

The proposed U.S. Bureau of Reclamation's (USBR) Dominguez Dam, just south of Grand Junction (see figure S2-4) would provide water-based recreation such as boating, fishing, and swimming. The USBR estimates that the dam would provide 300,000 to 500,000 recreation days in its first year of use, which would help to relieve some of the projected need for this type of recreation identified by the 1976 Colorado Comprehensive Outdoor Recreation Plan (see Regional Anlaysis, chapter 2, Recreation).

Growth in Mesa County would increase by 34,700 people from 1977 to 1990, which would require 114 acres of additional community active/improved park land (e.g., ballfields, playgrounds, tennis courts) to prevent overuse and deterioration of existing facilities (Bickert, Browne, Coddington, and Associates, Inc., 1977).

Visual Resources

Landscapes in the vicinity of Douglas Pass would continue to be developed for a variety of land uses, which subsequently would affect their visual quality by 1990. Continued exploration and

natural gas production could leave a residue of vehicle access corridors, well- platform sites, and gas pipeline rights-of-way that would create linear patterns on the landscape. Future grazing management could develop additional fences, water catchments, etc., and there could be further local development of the sand and gravel deposits.

The visual quality of the East Salt Creek drainage would remain a natural landscape with moderate cultural modification due to grazing, pipeline rights-of-way, and gas well sites. It could serve also as an adequate recreation drive for sightseers. Residential expansion is possible, but the upper portion of East Salt Creek should retain a relatively rural character for the next decade.

Socioeconomic Conditions

Population of Mesa County is expected to grow at a rapid rate to 110,700 people in 1990. Development of oil shale and uranium and the areas role as a regional center account for the growth. The Grand Junction area will become more urbanized resulting in the continued decline in the importance of agriculture in the local economy. Incomes are expected to be higher.

Garfield County is projected to grow at a rapid rate to 45,238 people in 1990 primarily because of the developing oil shale industry. Population growth from oil shale development, however, would occur mostly in western and central Garfield County, especially in and around the Rifle area. Glenwood Springs, because of its ability to absorb more population growth than other communities in the area, would also grow significantly from oil shale development.

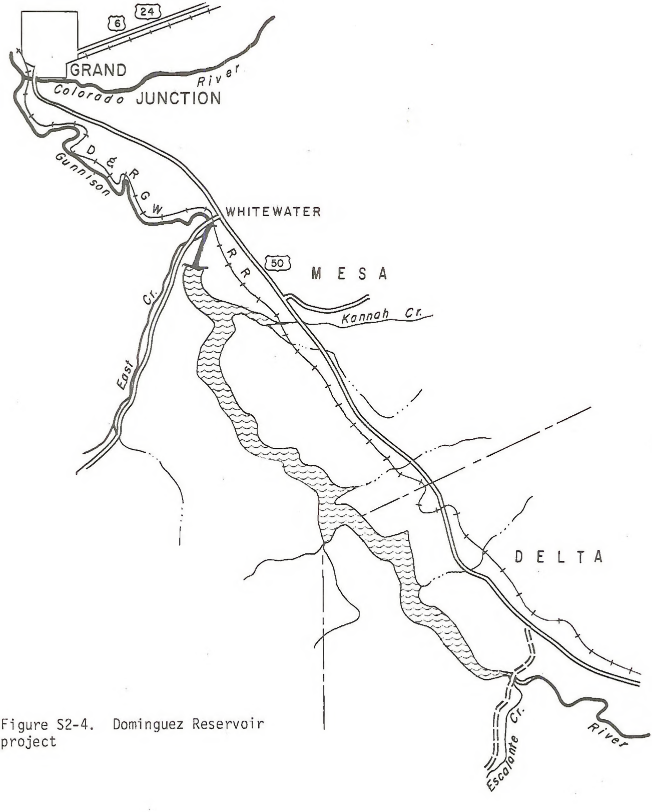


Figure S2-4. Dominguez Reservoir project

CHAPTER 3

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This mining and reclamation plan (M&R plan) was submitted for review after promulgation of initial regulations, 30(CFR): 700, required under Sections 502 and 523 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), but it does not fully reflect the requirements of the initial regulations. However, in this Environmental Statement (ES) the applicable initial regulations which are considered as required federal mitigating measures are being included as federal requirements in chapter 1 as if the M&R plan had been designed using the requirements of the initial. The Department of the Interior will not approve the M&R plan until Sheridan Enterprises has redesigned it to incorporate the requirements of 30(CFR): 211 and 30(CFR): 700. Therefore, to the extent possible at this time, the appropriate provisions of the Surface Mining Control and Reclamation Act are incorporated into the following impact analysis. Impacts are analyzed at three time points: 1980, 1985, and 1990.

Air Quality

Emissions from the Proposed Mine

Mining activity at underground coal mines usually produces dust, an air pollutant, in environmentally significant amounts. Dust that is generated within the mine is not considered to have an environmental impact since it is continuously controlled and contained in the mine. However, surface facilities at these mines also generate some dust which is released into the ambient air. Most of the dust is from fugitive emission sources; the term 'fugitive' connotes that the dust escapes from an unenclosed surface as a result of wind erosion or mechanical action, as opposed to being released from a stack or process vent.

The potential fugitive dust sources identified at the proposed Loma mine include conveyors, transfer points, truck loadout (through 1982), train loadout of coal (1983 to end of mine life), open storage piles, access and haul roads, and wind erosion of refuse piles and other exposed areas at the mine. A common source of fugitive dust at underground mines that is not projected for the Loma mine is crushing and sizing at the preparation plant. These operations should produce negligible emissions because a wet process will be used.

The procedure used to estimate emissions from each of the potential sources was to (1) determine the activity rate of the pollution- producing operation, (2) multiply that aclivity rate by an emission factor based on sampling of similar operations, and (3) reduce the calculated emissions by an appropriate amount to account for control equipment or dust suppression measures to be employed on the operation. Activity rates and control measures were described in the Loma mining and reclamation plan. Emission factors for individual mining operations were obtained from Colorado Air Pollution Control Division and a recent study of emissions from mining (Colorado APCD 1978, Axetell 1978).

Table S3-A presents estimates of fugitive dust emissions at the Loma site from each of the identified sources in 1980, 1985, 1990, and 2005 (end of mine life). These values are annual emissions, even though the activities are not continuous or uniform throughout the year. The esti mates are judged to be accurate within a factor of two (Axetell 1978). The emissions in table S3-A represent initial emission rates (tons per year) of suspended particulate from the operations. Some of these suspended particles fall out of the dust plume after they are emitted. This deposition is discussed further below.

The only potential air pollution sources identified at the Loma site other than fugitive dust sources were exhaust emissions from diesel-powered haul trucks and employees' motor vehicles on mine access roads. Emission factors for vehicular travel were obtained from the Environmental Protection Agency's (EPA's) most recent compilation of mobile source emission factors and reflect current legislation relative to future emission standards in high altitude areas (EPA 1978).

Emission rates per mile of travel are shown to decrease between 1980 and subsequent study years. In the case of Loma, these reduced emission rates more than offset increased activity rates projected when the mine is at full production in 1990. Estimated emissions of carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x), and sulfur oxides (SO_x) are shown in table S3-B.

These emissions are from both employee travel on the mine site and haul trucks.

The emissions of gaseous pollutants would not result in significant ambient concentrations on or near the proposed mine site. Although there are at least 60 tons per year of CO emitted in each of the study years, this pollutant must be present in relatively high concentrations (10,000 $\mu g/m^3$ vs 150 $\mu g/m^3$ for particulate) before it is harmful.

Annual Average Air Quality Impacts

In order to assess the impact of air pollutant emissions on the environment, ambient concentrations of suspended particulate were predicted with an atmospheric dispersion model. The model used to predict average concentrations that will result from the mine's emissions was the Climatological Dispersion Model (CDM) (EPA 1973).

CDM is designed for use in level terrain. Because of the irregular topography at the proposed site, CDM is really only capable of predicting concentrations in the main canyon or valley near where mining emissions occur. The site specific meteorological data reflected the prevalence of transport of the pollutants up and down the canyon from the mine. Because of the greater influence of the canyon on maximum concentrations near the mine, a separate model which considers reflection of the plume was used to predict maximum 24-hour concentrations. This short-term model is described in the following section.

The basic CDM model has been modified to incorporate a fallout function to simulate the deposition of the large suspended particulate as it disperses downwind. The fallout rates incorporated in the model were based on sampling data from several western coal mines and are functions of wind speed, atmospheric stability, and particle size.

The following input data are required for CDM: source locations; source emission rates; emission heights; locations where ground-level pollutant concentrations are desired; and frequency of occurrence of each of sixteen wind directions, six wind speeds, and six stability classes. Predicted concentrations are usually accurate within a factor of three.

The wind speed and direction data being collected at the mine site are not yet sufficient for modeling purposes (see chapter 2). Therefore, wind and stability data required for the model were obtained by modifying that from the Grand Junction airport to reflect orientation of the East Salt Creek Canyon. This wind rose was previously shown in figure S2-A. Emission data were presented in table S3-A.

Predicted increases in ambient concentrations resulting from Loma's operation in 1980 are shown on map S3-A. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 20 micrograms per cubic meter ($\mu g/m^3$) in a small area on the mine site near that section of haul road used for both raw and clean coal transport. Concentrations are predicted to increase by 5 $\mu g/m^3$ within 0.5 mile of either side of the section of haul road used to haul clean coal to the loading facility.

In future years, haul trucks would not be used to transport clean coal off site to the loading facility. As a result, total emissions from mining operations would be decreased significantly. Map S3-B shows the predicted increases in ambient concentrations from the Loma operation in 1990. According to the isopleths on this map, the mine would increase annual average particulate concentrations by 10 $\mu g/m^3$ in only a small area on the mine site. Concentrations are predicted to increase by at least 1 $\mu g/m^3$ for a distance of 2.5 miles north and south of the surface facilities within East Salt Creek Canyon. Predicted impacts for 1985 are approximately the same as for 1990, except that concentrations in Spink Canyon would be lower in 1985 because portals 4 and 5 would not yet be producing.

The predicted impact of the mine is less than the primary and secondary air quality standards for suspended particulate of 75 and 60 $\mu g/m^3$, respectively. It is also less than the air quality increment of 19 $\mu g/m^3$ allowable under the federal law concerning prevention of significant deterioration (PSD), except for a 1 mile section near the main haul road in 1980. Coal mines are not a source category requiring analysis under current PSD regulations.

Maximum Short-term Air Quality Impacts

The dispersion model used to predict maximum 24-hour particulate concentrations assumed Gaussian distribution of particulates away from the plume centerline, a constant wind direction, and complete reflection of the plume off both canyon walls. The basic dispersion equation is described in detail in *Workbook of Atmospheric Dispersion Estimates* (Turner 1970). The fallout function was not incorporated in the short-term model.

Several locations (receptors) up and down East Salt Creek Canyon were specified in the model for prediction of ground-level concentrations. At each receptor, the contribution caused by each emission source at Loma was calculated separately; individual source contributions were summed to determine the total concentration at the receptor resulting from the mining operations.

It was assumed that highest concentrations would occur when winds blew up or down the canyon for all 24 hours so the downwind receptors would be in the plume continuously. The annual average emission rates from table S3-A were also

used to predict maximum concentrations because no information was available on seasonal variations in production. Although it is expected that emission rates would vary somewhat throughout the year, the sources at Loma mine are not subject to great increases in emissions due to equipment malfunction or high wind speeds. Also, increased emissions at different sources would occur independently rather than simultaneously and would probably not occur at the same time as the most adverse meteorological conditions.

Predicted maximum 24-hour concentrations from the mine in 1990 are shown on map S3-C. With winds from the north, a maximum impact slightly above 90 $\mu g/m^3$ is projected to occur directly south of the surface facilities. At the mouth of the canyon (3 miles), the increase in concentrations on the worst day would be about 40 $\mu g/m^3$. With winds from the south, the maximum impact is predicted to be 65 $\mu g/m^3$. These concentrations are less than the 24-hour primary air quality standard of 260 $\mu g/m^3$ and the secondary standard of 150 $\mu g/m^3$, and they are projected to occur only in the immediate vicinity of the mining operations. Maximum concentrations in 1980 and 1985 would be 66 and 78 $\mu g/m^3$, respectively.

Because of the short-term dispersion model involves prediction of extreme conditions for meteorology and emission rates, it is probably slightly less accurate than the annual model.

Impact on Visibility

The addition of particulates into the atmosphere as a result of emissions from the mine will reduce visibility in the area. A calculation of the degree of visibility reduction depends on several parameters for which data are not available, the most important being size distribution of the particles. However, a rough approximation of visibility can be made based on suspended particulate concentrations. A relationship between these two variables in rural west-central Colorado has been empirically determined by Ettinger and Royer (1972); it is shown in figure S3-A.

It should be emphasized that this relationship was developed with uniform atmospheric particulate concentrations, not near a plume of fugitive dust containing relatively large diameter particles. Also, it does not consider visibility reductions due to precipitation. Therefore, the equation is more likely to predict visual range over an averaging period of a year than for a short-term period such as 24 hours.

As indicated on map S3-A, particulate concentrations in 1980 would be increased to a distance of over 5 miles to the south-southwest from the surface facilities. Along a line of sight down East Salt Creek Canyon, concentrations would be increased an average of about 8.6 $\mu g/m^3$ over this distance. Using the equation above and a background particulate concentration of 40 $\mu g/m^3$, the estimated reduction in visual range in the canyon as a result of mining emissions would be about 6 miles on an annual basis. Because of the limited area of air quality impact, average visibility would not be affected as much outside the canyon. For example, visibility would only be reduced an average of about 1 mile along an east-west line of sight from State Highway 139 south of the mine site. Visibility reductions in 1985 and 1990 would be less than in 1980.

Geologic and Geographic Setting

Topography

Impacts to the topography which would occur as the result of the proposed action would occur over the broad area from the Colorado River to the base of the Little Bookcliffs where the coal leases lie approximately 25 miles to the north. Three aspects of the mining operation would alter the natural contours of the area. These are the excavation and earthmoving associated with construction of surface facilities, long-term use of the refuse disposal area, and surface subsidence.

Excavation and earthmoving in preparation for construction of surface facilities would disturb a total of 676 acres (or 5 percent of the property) over the life of the mine (20 years). Of this, 20 acres (0.1 percent) was disturbed by exploration in 1977; 39 acres (0.2 percent) would be disturbed by exploration by 1980; 649 acres (4 percent) would be disturbed by the mining operation by 1985; and 676 (4 percent) acres would be disturbed by the mining operation by 1990. The effect which site preparation would have on topography is dependent upon the existing natural contour. Maximum disturbance would occur where large cut-and-fill structures would be needed for leveling, such as the portal sites at Munger Canyon and Spink Canyon. In other areas, such as the site proposed for the central facilities, cut-and-fill structures would be minimal because the existing slope is less than 10 percent. (See Soils.)

Long-term use of the refuse disposal are would mean gradual disturbance by continuous use of 30 acres in 1985 and 40 acres in 1990. This represents approximately 0.2 percent of the total project acres. No design plan for the refuse disposal area has been submitted, and final topography of the area is impossible to predict.

Surface subsidence of the area could be a more significant impact. Surface subsidence may occur over areas which have been mined out or burned out. A maximum of 8 feet of subsidence could occur over a maximum of 12,500 acres of the lease area. The burning of overlying coal beds, could

TABLE S3-A

FUGITIVE DUST EMISSIONS AT THE PROPOSED
LOMA MINE SITE

Emission source	Emissions, ton/yr		
	1980	1985	1990 & EML
Conveyor - 2 sections	22.8	109.4	156.3
Transfer points - 1 points	34.2	164.1	234.3
Preparation plant - wet process	neg	neg	neg
Truck loadout	0.1	-	-
Train loadout	-	0.5	0.8
Open storage - raw coal	11.3	11.3	11.3
- surge pile	11.3	11.3	11.3
Haul roads - raw coal	96.4	462.5	551.7
- clean coal	1102.0	-	-
- refuse	11.5	55.2	78.8
Access roads	4.1	11.3	21.6
Exposed areas - refuse	9.8	9.8	9.8
- railroad	67.9	67.9	67.9
- mine facilities	17.4	17.4	17.4
TOTAL	1388.8	920.7	1161.2

TABLE S3-B

EMISSIONS OF GASEOUS POLLUTANTS FROM THE
PROPOSED LOMA SHERIDAN MINE SITE

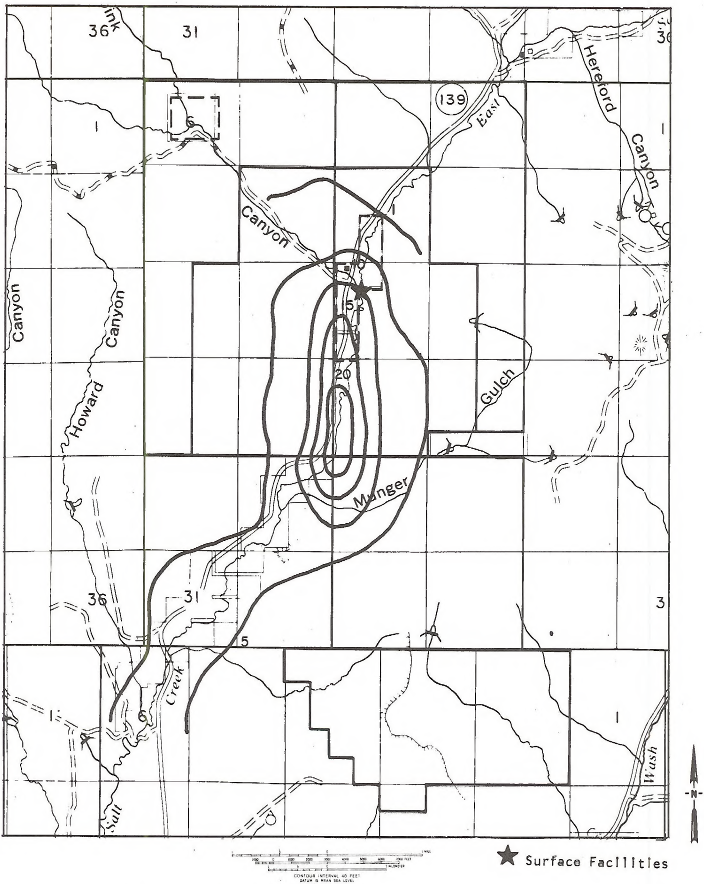
Year	Total emissions from vehicles, ton/yr			
	CO	HC	NO_x	SO_x
1980	74.1	8.0	17.1	3.8
1985	62.3	6.1	13.1	1.9
1990	60.9	6.2	16.2	2.5

$$L_v = \frac{24}{0.2 + 0.007\ M}$$, where

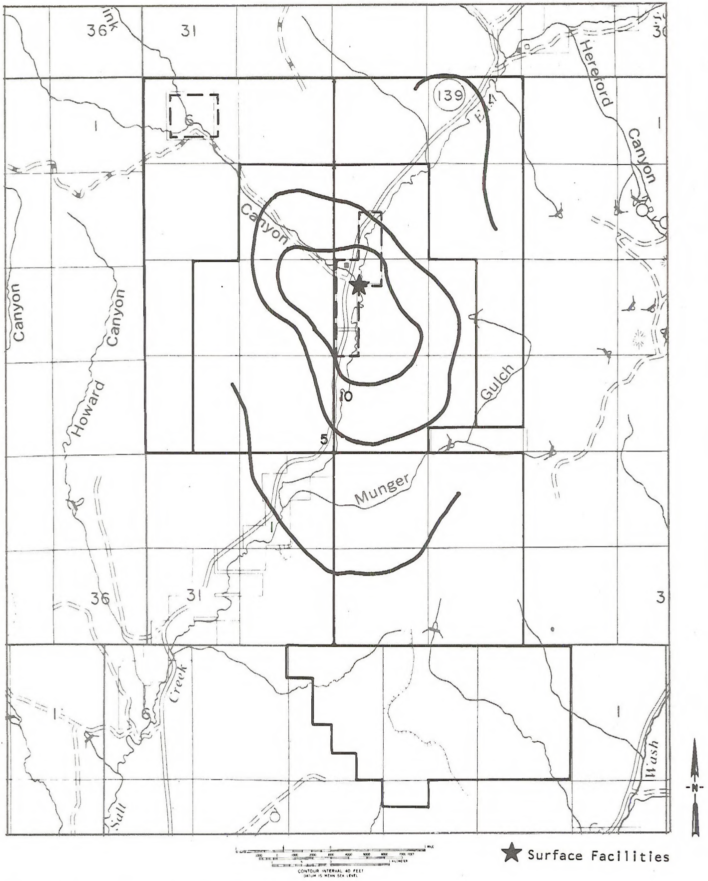
L_v = Average visual range, miles

M = Average particulate concentration (micrograms per cubic meter)

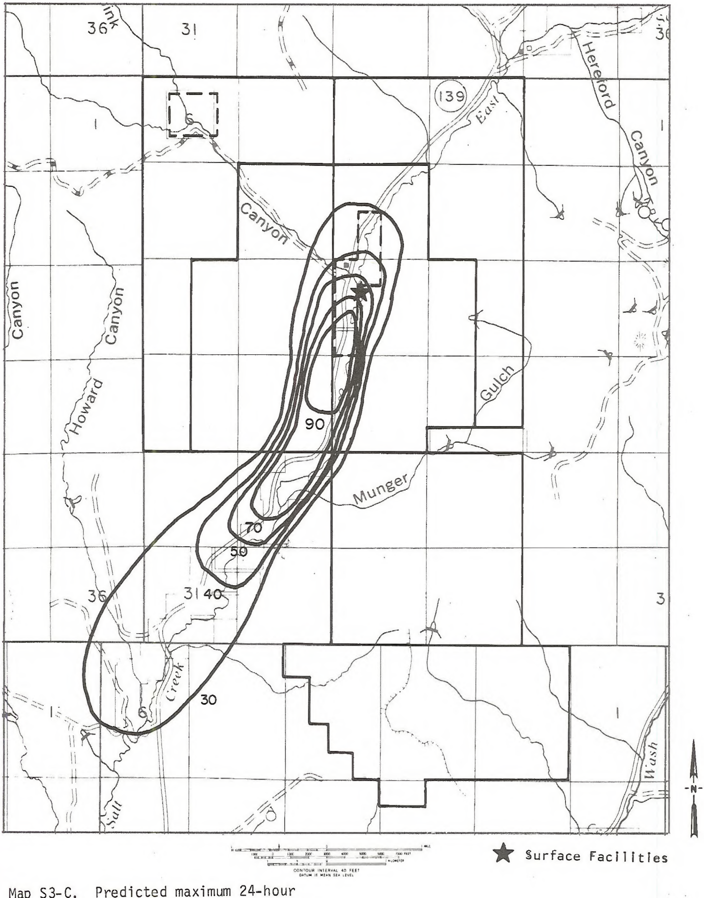
Figure S3-A. Relationship between visibility and suspended particulate concentrations in rural west-central Colorado (Ettinger and Royal 1972).



Map S3-A. Predicted increases in ambient concentrations in 1980 (micrograms per cubic meter)



Map S3-B. Predicted increases in ambient concentrations in 1990 (micrograms per cubic meter)



Map S3-C. Predicted maximum 24-hour concentrations in 1990 (micrograms per cubic meter)

occur following initial subsidence from mining as air circulation at depth is increased. In total, the results of both mining and burning of coal beds could induce approximately 20 feet of subsidence. (See Mineral Resources and Soils.)

Paleontology

Plant, invertebrate, and vertebrate fossil materials would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. The primary impact would probably result directly from the mining operation. Given the overall character of the stratigraphic column, it is probable that some fossils would be destroyed. However, this stratigraphic section is only moderately likely to yield significant fossils when compared with other parts of the ES area.

All exposed fossil-bearing formations within the region could also be affected by increased vandalism and unauthorized fossil collecting as a result of increased regional population. The extent of this impact cannot presently be assessed due to a lack of information on such activities.

As a result of the above disturbance, an undetermined number of fossils would be lost for scientific research, public education (interpretive programs), etc. On the other hand, as a result of development, some fossil materials would also be exposed for scientific examination and collection. Due to lack of data and accepted criteria for determining significance, the importance of these impacts cannot presently be assessed. When completed, the provisions of the Bureau of Land Management (BLM)-U.S. Geological Survey (USGS) memorandum of understanding relating to the protection of paleontological resources on federal lands will provide evaluatory criteria so that a determination may be made.

Mineral Resources

Coal

The mining of the estimated 100 million tons of recoverable coal reserves from the Loma project over an estimated 20 year period would result in the depletion of a nonrenewable energy source. The coal produced is expected to be exported to utility plants to the midwest and southwest for use in the production of electrical energy.

The Cameo seam occurs as a single unit 20 to 25 feet thick and as two splits with 70 to 80 feet of interburden between them; the lower split is about 8 to 10 feet thick and the upper split is about 5 to 13 feet thick. Mining of the two splits must be correlated as subsidence from mining the lower bench would have an effect on the upper bench. Either the upper bench should be mined before development in the lower bench or simultaneous development of both benches could be done if mining in the upper bench is carried approximately five degrees, vertically, ahead of mining in the lower bench.

The underground mining of the coal resources by the proposed mining methods would result in recovery of an estimated 40 percent of the coal reserves. This is the most efficient method of mining the leased coal. Because of the nature of underground caving and resultant high contamination, future recovery of the abandoned 50 to 60 percent of the coal reserves is not considered as feasible under present technology and, therefore, must be considered as lost. The estimated recoverable coal reserves under the Loma project constitute approximately 12 percent of the total coal reserves over 42 inches in the Garfield County portion of the Colorado section of the Little Bookcliffs coal field.

Oil and Gas

If oil and gas are discovered under the Loma project, settlement must be reached between the well owners and the owners of the coal lease, as to which of the nonrenewable energy resources will be produced. If an area of coal must be left unmined around the well, that coal resource would be lost, since it would be uneconomical to return to an area and mine isolated 'blocks' or 'pillars' of coal.

Water Resources

Surface Water

There would be no significant impact on the surface water quantity through the lease area. All water used in the mining operations would come from the Colorado River, which is 17 miles south. Based on the average flow rate of 5,847 cubic feet per second (cfs) for the Colorado River, the 10 cfs pumping rights owned by Sheridan is also insignificant.

An impact which may be more severe is the increased water demand for domestic water associated with the projected population increase due to Sheridan's mining operation. Based on the projected population increases from the socioeconomic section, there would be an increased demand for municipal water of 339 acre-feet per year in 1980, 919 acre-feet per year in 1985, and 1,175 acre-feet per year in 1990. However, some of this demand would be fulfilled by ground water through domestic wells. It is not possible to predict how many people would elect to live within the county where municipal water is unavailable.

Ground Water

The process of developing underground mine shafts interrupts the ground water system within aquifers that have been disturbed. However, be-

cause of the arid, unpopulated environment and the lack of evidence of ground water during exploration drilling, this impact is expected to be insignificant.

Water Quality

Any human development usually causes a decrease in water quality within an area due to increase in erosion and sedimentation. By diverting runoff from higher, undisturbed areas around surface disturbance, and controlling and holding runoff from disturbed areas in sedimentation ponds, impacts can be minimized. Specific information on diversion and water control structures has not been given by Sheridan. However, Sheridan will be required to comply with all of the state and federal regulations.

The proposed refuse disposal location is within the mouth of a natural water course with a drainage area of 2 square miles and an elevational change of 700 feet. The total drainage area above the finished refuse pile would be approximately 1.8 square miles. A drainage system around and through this refuse disposal area has not been given. A 10-year 6-hour storm event, with a precipitation rate of 1.3 inches per hour, and a 25-year 6-hour storm event, with a precipitation rate of 1.5 inches per hour, would produce peak flow rates through this proposed refuse area of 389 and 499 cfs, respectively. Proper design of the on- site drainage system as outlined in 30(CFR): 717.17(c) and 717.17(e) will minimize or elimate a large percentage of the stream degradation by sediments and salts. However, it would be effective only for events less than 10-year/24-hour. Runoff flow rates of higher magnitudes would cause significant increases in suspended sediment and degradation of the water quality.

Flood Hazard

The possibility of flash flooding presents a very real hazard within the lease area. All facilities and portal areas except, portal areas No. 3 and No. 4, are liable to inundation by flood waters. Diversion ditches to control these flood waters have been proposed. However, design criteria have not been given and thus cannot be analyzed. Failure of these control structures may result in the loss of life and property to the mining company.

Flash flooding through the refuse disposal area presents a very real potential for a high erosion hazard and downstream sedimentation. Although this may not have any significant impact to the poor quality of East Salt Creek, this sediment will eventually enter the Colorado River causing further degradation to this system.

Soils

Soil impact would result from surface subsidence, from the construction and operation of mine surface facilities, and from urban expansion due to increased employment.

Coal removal could cause an estimated maximum surface subsidence of 8 feet (see Topography). Soil impacts would be minimal where no breaks occurred in the surface mantle. However, localized slumps could expose narrow bands of bare soil material; surface runoff could then be redirected, leading to gully formation.

The construction and operation of mine surface facilities would affect approximately 39 acres by 1980, 649 acres by 1985, and 676 acres by 1990. These values include 30 acres of previous disturbance due to exploration activities and, beginning in 1985, about 497 acres from the utility and rail corridor. Approximately 160 acres of the proposed corridor lie south of the Highline Canal and include areas classified as prime farmland. Erosion would increase perhaps two to three times over the moderate to high natural rate in response to surface disturbance. Within the design limitations of the proposed action, most of this erosion would be contained on-site by drainage systems and other sediment control measures. However, these structures are only designed to handle a 10-year/24-hour precipitation event; runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site could enter nearby stream channels (see Aquatic Biology section). Over the 28-year mine-life, there is a 95 percent chance of exceeding this design value.

The net effect of increased erosion, along with a deterioration of soil structure and biological activity, would be a reduction in soil productivity. Any such reduction, although unquantifiable at present, would further complicate inherent revegetation problems of low natural moisture, poor topsoil, and often steep terrain. These problems would prolong the efforts necessary to achieve successful reclamation (see Vegetation).

Off-site disturbances due to mine-related population increases would amount to 74 acres by 1980, 199 acres by 1985, and 316 acres by 1990. The exact location of these acres cannot be predicted, although at least some portion would likely come from croplands in the Grand Valley. To this extent, crop production capacity would be permanently lost. Soil erosion could initially increase from two to three times the natural rate, then gradually decrease as home sites are planted or otherwise stabilized.

Vegetation

Approximately 39 acres of vegetation are expected to be disturbed by the construction of the Loma mine by 1980, 649 acres by 1985, and 676 acres by 1990. The water pipeline and railroad from the Loma mine to the town of Loma would cause 433 acres of this disturbance by 1990. A maximum of 65 acres of this disturbance would be on agricultural land with the rest (approximately 368 acres) on rangeland sparsely covered with saltbush or greasewood.

The remaining 243 acres of the disturbance by 1990 would be due to the construction of the central facilities, the refuse pile, and the mine portals and associated facilities. One hundred twenty acres of this distrubance would be in the pinyon-juniper type, 28 in the greasewood type, 22 acres in the sagebrush type, 24 acres on sparsely vegetated (south-facing) slopes of the saltbush type, 48 acres on land that has previously been disturbed and currently consists of annual weeds and grasses, 1 acre on riparian vegetation consisting of cottonwoods, and 1 acre on irrigated farmland planted in hay. The impacts of the vegetation disturbance would be to reduce the visual aesthetics of the area, increase soil erosion, and reduce the numbers of wildlife and livestock in the area (discussed in the appropriate sections).

Sheridan would be required to revegetate the 676 acres of disturbance at the Loma mine and railroad sites upon abandonment of the mine. Specific revegetation measures that would be required by the federal coal mining regulations are stated in 30(CFR): 717.20, and 30(CFR): 211.40, 211.41, and 211.62, the *Federal Register* (Vol. 42, No. 239, and Vol. 41, No. 96). These regulations cover the operator's (Sheridan's) responsi bility and length of liability for revegetation; 30(CFR): 211.40(a)(13)(i) states that 'a diverse vegetative cover capable of self-regeneration and plant succession and at least equal in density to the natural vegetation, shall be established on regraded and other affected lands.'

Problems may be encountered in attempting to revegetate the disturbed areas (such as steep south-facing slopes, low annual precipitation, high soil salinity, weed infestation) which may prolong the period of time required for successful revegetation. In such cases, a five-year extension of Sheridan's responsibility for revegetation efforts may be necessary, beyond the five-year period initially established by the government's authorizing office responsible for monitoring revegetation at the Cotton Creek mine site, discussed in 30(CFR) 211.40(a)(13)(ii).

Urban expansion caused by population increase related to coal mining would result in the disturbance of an estimated 74 acres of vegetation by 1980, 199 acres by 1985, and 316 acres by 1990. It is probable that much of this disturbance would be on agricultural land surrounding existing population centers.

Increased numbers of people in the area would result in additional disturbance of native vegetation, particularly by off-road-vehicle use. This disturbance would lessen the productivity of native vegetation for livestock and wildlife forage. The problem would be most serious in low altitude Mancos shale hills and in alpine areas above timberline.

Endangered and Threatened Species

No endangered or threatened species would be affected by this proposed action.

Wildlife

Due to construction of mine portals and roads to permanent facilities, disposal site, and permanent facilities for washing and loading coal, 39 acres of habitat would be destroyed by 1980, 649 acres by 1985, and 676 acres by 1990. Smaller, less mobile animals and burrowing species would be killed outright during construction activities. Human activity and destruction of food and cover would eliminate habitat on this acreage for the larger, mobile species, such as mountain lion, black bear, and golden eagle, and to a lesser extent, mule deer, bobcat, coyote, and ringtailed cat. Pellet group transects which have been run near the tract indicate use of 42 deer days per acre; see table S3-1 for the number of deer that could be supported by these acres. Some habitat might remain for very tolerant species, such as deer mice, English sparrows, and mourning doves. Vehicle-animal collisions would increase with more traffic on the roads, primarily during the winter months.

In addition, approximately 4,000 acres of adjacent habitat would be degraded due to increased human activity. The degree of disturbance would vary, depending on proximity to mining facilities, topography, and vegetative cover. This would be an average reduction of 50 percent, assuming that impacts would be progressively less, the farther the habitat is from the distrubance. Mountain lion and black bear use is expected to cease in areas adjacent to the facilities because of their low tolerance of human activity. Other species that would be affected but not totally excluded from the 4,000 acres would be mule deer, golden eagle, coyote, bobcat, and ringtailed cat.

The number and location of air shafts that would be required is not currently known, but surface roads for construction and maintenance of ventilation facilities would increase the area affected by the above impacts. Seasonal mule deer migrations north and south through the area would be only slightly disrupted, but daily movements of mule

TABLE S3-1

IMPACTS ON WILDLIFE

Year	Total Disturbed Acres	Number of Animals that These Acres Could Support					Additional Acres Disturbed	Additional Animals that Could be Supported		
		DDA	D	EDA	E	WH		D 50%	E 50%	WH 50%
1977	20	42	5	-	-	-	4,000	509	-	-
1980	39	42	11	-	-	-	4,000	509	-	-
1985	649	42	171	-	-	-	4,000	509	-	-
1990	676	42	178	-	-	-	4,000	509	-	-

Note: DDA = deer days per acre; EDA = elk days per acre; D = deer; E = elk; WH = wild horses.

deer would be affected by roads and conveyors connecting the mine portals and main loading and washing facilities. In addition, all big game species would be more susceptible to legal or illegal hunting as access is improved on the area.

It is difficult to predict to what extent subsidence would affect wildlife because of lack of information about the effects of subsidence. In general, it can be expected that animals would avoid using an area which is subsiding, because of its instability. Secondarily, individual animals could be frightened by humans in the area (mine workers, sightseers, etc.) and driven into the subsidence area where they could be injured or killed by the sharp changes in topography. To some extent, however, wildlife would gradually develop trails through the areas, which would lessen the danger for wildlife.

One active and one suspected nest site for golden eagles could be affected. The greatest threat to the continued use of these sites is human activity above or at the base of the nesting cliffs. The March to July period would be the most critical. Nest sites are selected at the beginning of this period, and disturbance after that could cause the adults to abandon their young.

The open desert type is an important raptor hunting area, as demonstrated by the large number of golden eagles and prairie falcons which nest located along the face of the Little Bookcliffs. Construction and operation of the railroad, pipeline, and power lines to the lease tract would reduce the prey base for raptors and carnivores on 4,000 acres; during construction, prairie dogs, deer mice, Ord kangaroo rats, burrowing owls, and most reptiles would be killed along the routes. Power lines would be a physical hazard to birds in flight and an electrocution hazard to the larger raptors. On the open desert, power poles would be especially attractive as perches, since fewer other sites are available. If electrocution hazards are minimized by proper pole design, raptor hunting opportunities would be enhanced by the addition of these perch sites.

Approximately 1 mile of riparian habitat, consisting of scattered cottonwoods along East Salt Creek, would be lost. Several species of toads, wandering garter snakes, and a number of passerine birds, partic ularly those that nest in tree cavities, would be lost from this area.

Antelope movements will be disrupted by train traffic. Movement could be blocked if the railroad right-of-way is fenced in a manner which does not allow passage of antelope. In addition, locating the railroad immediately adjacent to East Salt Creek would disrupt the activities of many animals often attracted to the water and riparian vegetation. Disturbance would occur during construction and continue for as long as the line is in use. Locating the railroad away from East Sale in desert shrub type would lessen the total number of animals and species affected.

Locating the railroad on non-agricultural lands along East Salt, West Salt or Badger Washes could conflict with DOW plans to obtain these lands as mitigation areas for another project (the lining of irrigation ditches by the Bureau of Reclamation under the Grand Valley Salinity Control Program). This USBR project would cause a loss of game bird habitats and mitigating measures are being developed to provide game cover interspersed through the agricultural lands.

Secondary impacts from the proposed action would include increased human population, resulting in expansion of urban areas onto agricultural and some crucial winter range; increased vehicular traffic, resulting in an increase in vehicle/animal collisions; and increased recreation use of the area, causing an additional stress on the animals and increasing legal and illegal harvest of animals. This illegal kill could increase 10 time or 1,000 percent over current estimates (Al Whitaker 1978, personal communication).

Endangered or Threatened Species

No endangered or threatened species would be affected by the proposed action.

Aquatic Biology

There is no aquatic habitat on the site so the only possible impact that might occur would be 20 miles down East Salt Creek at the confluence with the Colorado River. Any water discharged from the mine site would be less than 1 cfs and would not adversely affect the present, extremely poor natural quality of the water in East Salt Creek. Therefore, no impact to the aquatic species in the Colorado River is expected from the proposed discharge of 1 cfs or less to East Salt Creek. Any mine water discharge would still have to comply with all state and federal water quality control laws.

Endangered or Threatened Species

Sheridan site maps show the proposed location for the coal refuse disposal area in sections 17 and 20, across and blocking the drainage way for several small canyons. In a flash flood, this pile would wash into East Salt Creek and into the Colorado River and could potentially wipe out parts of the population of threatened and endangered fish species in the Colorado River. Some of the proposed facility sites are within the flood plain of East Salt Creek and pose the same type of potential impact as the refuse pile.

Cultural Resources

Archeological Resources

Although no archeological sites were identified in the Class III survey (for drill holes and access roads), the presence of petroglyph AR-05-07-382 within the lease area and the occurrence of archeological sites in the vicinity indicate the presence of prehistoric inhabitants. The potential for subsurface sites also exists (Connor 1977). Therefore, construction and operation activities affecting a total of 39 acres by 1980, 649 acres by 1985, and 676 acres by 1990 could result in the destruction and alteration of archeological data that remain undetected by archeological survey. In addition, subsidence, as it could affect 12,500 acres of the lease property, would create surface disturbances which could displace or damage existing archeological values. The presence of 900 mine employees by 1990 would mean increased exposure of existing archeological values in the proposed area to public passage.

Site AR-05-07-382 is situated within an area of proposed mining activity and would be impacted by the proposed action. Its location in a heavily trafficked area would make it susceptible to vandalism (refer to chapter 4, regional volume, for discussion of impacts of vandalism). In addition, alteration of the surrounding environment of the site would introduce physical elements that would disrupt the aesthetic integrity of the site as well as the ecological backdrop in which the site can best be viewed and understood.

Prior to approval of the proposed action, a concurrence of approval could be developed by the BLM with Sheridan concerning the company's responsibility for the protection of cultural resources, in addition to those responsibilities required by law. This would include provisions for work stoppage and compliance should archeological sites be identified during construction and mining activities. In addition, should areas of surface subsidence be identified, provisions for a Class III survey of the impact areas could be made to minimize the potential damage to archeological sites.

Historical Resources

Because the extent of historical sites in the mine area is not fully known, the following impacts may occur. Surface disturbing activities, such as mining or construction of facilities and roads, could disturb buried sites or destroy sites that might be considered worthless by the project engineers. Because of the intrusion of buildings, roads, fences, etc., some sites might lose the aesthetic integrity which is important to the overall quality of the site, as outlined in 36(CFR): 800.9. Sites remaining near or at the project might be vandalized due to increased access or human use; damange could include 'stripping' of wood, removal of artifacts, etc.

Prior to approval of the proposed action, a concurrence of approval could be developed by the BLM with Sheridan concerning the company's responsibility for the protection of cultural resources. This would include provisions for work stoppage and compliance should historic sites be identified during construction and mining activities. In addition, should areas of surface subsidence be identified, provisions for a Class III survey of the impact areas could be made to minimize the potential damage to historic sites.

Transportation

Highways

For the present all coal produced by the Sheridan mines would be hauled by truck on State Highway 139 to a railroad loadout near Loma. This traffic would be concentrated in an eight-hour daytime shift, resulting in one loaded truck every 49 seconds (with returning empty trucks equally as often). This heavy use would be detrimental to the existing highway, which may require extensive improvements such as resurfacing and widening.

Increases in accident rates along State Highway 139 could also be expected from frequent coal truck traffic. Such increases would be difficult to quantify because of the present light traffic over the road.

Noise levels would increase significantly due to coal hauling on State Highway 139. Exact levels of such noise increase have not been quantified for these remote areas.

Traffic on State Highway 902 would also increase because of the mine personnel driving to and from work. Assuming an average of 1.5 persons per car, this could generate as many as 332 trips per day with a corresponding number of return trips. Traffic would be heaviest just before and after shift changes.

Railroads

Sheridan proposes to construct a railroad spur from Loma to the mine site. Coal haulage on the highway would continue only until this is completed, at which time the road impacts mentioned would cease. Because the route of the spur has not been selected, an analysis of the impacts associated with it is not possible. An environmental analysis of the spur will be completed before construction begins.

Airlines

The only effect that development of this project would have is increased passenger loads into Walker Field at Grand Junciton. Facilities there would be adequate to handle the increase.

Livestock

Development of the central facilities, mine portals and associated facilities, refuse pile, water pipeline, and railroad would result in the loss of 3 animal unit months (AUMs) of livestock use annually on 39 acres of natural vegetation by 1980, 41 AUMs annually on 649 acres by 1985, and 48 AUMs on 676 acres by 1990. The livestock qualifications (maximum livestock use permitted) on the public land disturbed would be reduced due to the loss of livestock forage. However, the loss of AUMs represents less than 3 percent (2.6 percent) of the AUMs present on the coal lease tract and would not cause severe hardship to the livestock operators concerned.

The disturbance of agricultural land by the water pipeline and highway right-of-way (maximum of 160 acres) may adversely affect the livestock industry in the area because it is probable that much of the land disturbed would be irrigated and nonirrigated hayland and pasture. These lands are used as livestock wintering areas, and the hay harvested from them in the summer is used to feed livestock during winter. The loss of them may result in hardship on some livestock operators.

The above discussion is also true for the acreage disturbance resulting from urban expansion due to population increase from the proposed action: 74 acres in 1980, 199 acres in 1985, and 316 acres in 1990. It is probable that much of this disturbance would be on irrigated and nonirrigated hayland and pasture.

Approximately 88 AUMs per year would be restored to the coal lease upon revegetation of the disturbed areas after the mine is abandoned, which is expected to 28 years after production is started (with the exception of the land disturbed from urban expansion, which will not be reclaimed). This is an increase of 40 AUMS per year over what the land currently provides. This prediction is based on the assumption that the species mixture used in revegetation would consist primarily of grasses, and that palatable grass species would be a much higher percentage of the reestablished vegetation (to as much as 70 to 90 percent) than they were of the original vegetation. (Further discussed in the regional volume.) The AUM figure also reflects the possiblity that it may be difficult to revegetate desirable forage grasses in the East Salt Creek floodplain (due to high salinity) and that less palatable species which are more tolerant of saline conditions (such as inland saltgrass or greasewood) may be required for successful revegetation.

Some cattle may be killed by haul trucks going to and from the mine portals, the central facilities, and the refuse pile.

Recreation

The influx of additional populations due to the Sheridan site and the subsequently increased demand for recreation opportunities could have an impact on existing recreation resources and facilities, particu larly community facilities in the Grand Junction-Fruita area. Since Grand Junction's recreation facilities are now fully utilized (Grand Junction Recreation Department 1977), increased use would result in overuse which would lead to their deterioration and a lowering of the capacity to provide enjoyable recreation. The community facilities needed to meet the increased demand and prevent overuse are projected in Table S3-2 which shows a need for 2.2 acres of active/improved park lands by 1980, 6.6 acres by 1985, and 8.9 acres by 1990. Capital investments to provide these facilities are also projected in Table S3-2.

The increased use of recreational facilities could be offset by providing additional facilities. The Heritage Conservation Recreation Service, through the Land and Water Conservation Fund Act (PL 88-578), could provide monies for this purpose if matching funds are provided by the local agency. The Mineral Leasing Funds (Co SB No. 35, Sect. 2; 34-63-102), which can be used for public facilities and services, could also be used for recreation facilities. In addition, BLM could provide lands for these recreation facilities under the Recreation and Public Purposes Act, 43(CFR): 2740, which allows non-profit associations to acquire lands for recreation purposes consistent with their creating authority. These actions, however, cannot be required by the Department of the Interior. Therefore, the initiative for taking these courses of action would be up to the local agencies and the success of mitigation would depend on their commitment to it.

The increased demand for dispersed recreation opportunities (e.g. hunting, hiking, ORV use, etc.) should not adversely affect the recreation resource; however concentrated use, such as an ORV rally, could lead to vegetative deterioration and a lower quality recreation experience on that site. Increased use of recreation facilities (such as Highline Lake Recreation Area) would lead to increased maintenance costs for the managing agencies. The extent of the increased usage and costs are not known.

The Sheridan mining activity could have an impact on recreation users of State Highway 139, which goes through the lease site and would be the coal truck haulage route. The highway is a major route to Dinosaur National Monument and the Douglas Pass area and had a traffic volume of 470 vehicles per day in 1976 (Colorado Division of Highways, 1976). The projected 157 coal trucks per day in 1981 and mine employees could cause road deterioration and increase the probability of accidents.

TABLE S3-2

SHERIDAN: ADDITIONAL COMMUNITY RECREATION FACILITIES DEMAND

	1980	1985	1990
Population Growth	650	2,000	2,700
Active/improved parks a/ (3.3 acres per 1,000 residents)	2.2 acres	6.6 acres	8.9 acres
Capital investment ($66,666 per 1,000 residents)	$43,333	$133,332	$179,998

Source: Bickert, Browne, Coddington, and Associates, Inc., 1976.

a/ Ballfields, tennis courts, playgrounds, etc.

The Sheridan lease site is not now identified for any wilderness study and due to the presence of existing roads is not expected to be so identified.

Visual Resources

East Salt Creek

The open, natural setting of the East Salt Creek valley would be significantly altered by construction of the proposed Sheridan central facilities and a portal entry. A radiating road network and power line grid would serve the central offices, wash plant, etc., and the nearby portals in Spink, McLane, and Munger canyons, so that specific landscape alterations would occur for about 3 miles along East Salt Creek. However, the associated visual changes would continue 20 miles south to the Loma area because of trucks hauling coal. In addition, visual clarity in the valley depression would be lowered by 6 miles because of increased particulate matter which would create an artificial haze condition.

The view characteristics of East Salt Creek focus maximum attention on the valley floor, so that buildings, parking lots, conveyors, and coal storage structures would be closely looked at and the individual components of the operation would be viewed together as a major complex of wires, roads, buildings, etc. Previous agricultural development was small scale and in harmony with the natural landscape; the proposed mining complex introduces a new, larger scale which contrasts significantly with existing landscape modifications.

The portal facility would also be visually dominant along East Salt Creek, changing the natural landscape character. Interruptions of vegetation textures, natural color zones, and existing linear components of the landscape would further emphasize the presence of the mining operation.

East Salt Creek has been designated as a VRM Class II (see appendix F), which stipulates that changes on this landscape should not be evident nor disrupt the characteristic form, line, and color of this visual zone. A contrast evaluation of the proposed facilities indicates that the VRM Class II could not be maintained and would drop to a Class V for the life of the mining operation.

Spink Canyon

The mine portal complex of office, raw coal bin, parking lot, electrical substation, etc., would introduce new forms into the undeveloped Spink Canyon. Landform alterations and interruptions of vegetation textures, soil colors, and rock strata lines would prevent the blending of this addition into the characteristic landscape.

Spink Canyon has been rated (see appendix F) as a VRM Class IV, which allows landscape changes to dominate the existing visual character, but these changes should reflect a natural origin. A contrast rating of the proposed additions demonstrates that Class IV criteria could not be met; they would, therefore, be lowered to Class V.

Munger Canyon

The steep side slopes of Munger Canyon are presently altered by a single-lane access road and portal terraces. Additional road widening and terrace formation would leave a cut-and-fill scar; it is questionable whether the scar could be reclaimed, because of the fill requirements. The present VRM Class IV allows changes to dominate the existing visual character, but they should reflect a natural origin, which would not be possible. The resultant VRM Class V would be short-term for the mine life and would require reclamation, which would be a long process for Munger Canyon; the lack of natural moisture and prohibitive fill requirements would generate a long-term visual impact.

McLane Canyon

The flat-bottomed landform of McLane Canyon would absorb the proposed portal site without permanent disruption. Existing terraces and the road cut would accommodate portal expansion, but additional buildings and activity patterns would lower the existing VRM Class IV to a Class V because the visual contrasts could not reflect a natural origin. Changes in landform, texture, line, and color (see appendix F) would be disruptive in this cliff-enclosed canyon, but the landform could be returned to approximately the original contours.

Refuse Canyon

The deposition of mine waste in this unnamed drainage would permanently change its landform character. Soil colors, vegetation textures, and existing edge lines would be buried, which would establish a contrast that would require the exiting VRM Class IV to drop to a Class V. Assuming the refuse piles could be stabilized and revegetated, the major visual impact would be the landform change of the canyon.

Railroad Right-of-way

The development of an approximately 19-mile railroad, pipeline, and power line corridor across the Grand Valley would add another linear land use to existing roads, power lines, ditches and fences. As a new land form, the railroad embankment would have a weak to moderate contrast depending on the site-specific cut-and-fill requirements. The embankment would establish a barrier for vehicle circulation and, if it were fenced, would also affect livestock movement; these problems would influence the local perception of the rail corridor.

Other visual contrasts due to vegetation disruption and soil color contrasts would be created by the cuts-and-fills. These descriptions would eventually blend with the surrounding landscape as weathering and revegetation reduce the contrasts.

Rail activity on the spur corridor would also have visual implications, especially for local residents. Heavy utilization by long trains could have negative implications due to noise and intersection delays. The visual implications of the rail spur would be directly linked to the other problems it creates, which, if minor, would produce no major visual impacts.

Socioeconomic Conditions

Demography

Even though the Sheridan operation is located in Garfield County, all existing communities within the vicinity of the site are located in Mesa County. All population growth related to the development of the site is expected to occur in Mesa County. That population growth is projected to be 865 persons by 1980, 2,340 persons by 1985, and 3,710 persons by 1990. These figures were arrived at through the Colorado Population and Employment Model, by calculating population growth in Mesa County, both with and without new employment due to Sheridan, and using the difference between those two projections as the new population attributed directly to Sheridan.

Most of this population growth is expected to occur in either Fruita or the Grand Junction area, with a small percentage residing in the small communities of Loma and Mack. Fruita is the closest town to the site (figure S3-1), and it would be able to provide for 1,500 to 2,500 new residents, given the constraints on its water system. Grand Junction and its surrounding communities are all within a reasonable commuting distance of the site, so that available housing should determine, for the most part, where the new population will settle.

Community Attitudes and Lifestyle

General changes expected in attitudes and lifestyles due to increased coal mining in the area are discussed in the regional volume. Some of the most visible effects of the Sheridan development should be upon the small community of Loma, which would be subject to all the coal truck traffic between the mine and the railroad loadout activities. Significant growth in Fruita would make it a more viable community, decreasing its economic dependence on nearby Grand Junction.

Community Facilities and Services

The projected community facility requirements for Mesa County associated with the Sheridan operation are listed in table S3-3. These figures were derived in a similar manner to those contained in the regional volume in table R4-19.

These cost figures do not reflect the major capital expenditures which are expected to be made in Mesa County to upgrade water and sewer treatment systems regardless of the proposed action. Local governments would be dependent upon a portion of new revenues generated by the proposed action to assist in paying for projects like the $5 million water system expansion program and the $14 million sewer system expansion program planned for Grand Junction (see chapter 2 regional volume).

Projected increases in the local revenues attributed to the Sheridan development are listed in table S3-4. These revenues are based on increases in residential, commercial, and industrial property values, increased sales tax revenue resulting from population growth and water and sewer service fees. Since the Sheridan mine itself would be located in Garfield County, that county would receive an increase in assessed valuation estimated to be $1.8 million in 1980, $62.8 million in 1985, and $66.5 million in 1990.

The revenues listed in table S3-4 reflect total revenues expected to flow to all local government entities. Since the estimated increases in community facility expenditures would be borne by county, municipal, or special district units of local government, the school district revenues were subtracted out. This lowers the amount of locally derived revenue for county, municipal, and special district units of government to an estimated $101,200 in 1980, $469,100 in 1985, and $669,200 in 1990. These locally derived revenues should be insufficient to meet the projected community facility costs (amortized capital costs and operating costs) due to the development of the Sheridan site until after 1985.

Substantial property taxes would accrue to Garfield County from this mine. Using an investment level of $36 per annual ton of production, a total investment of $180,000,000 would be required. Assessed value of this amount would be $54,000,000. At a property tax levy of 75.65 mills, the tax would be $4,085,100. Property taxes on the coal produced would be $138,550 in 1980, $666,190 in 1985, and $948,990 in 1990. Total property taxes would reach $5,034,090 by 1990. Using 1976 tax rates, $1,409,550 of the 1990 total would go to the county, $3,523,860 would go to the school districts, and $100,680 would go to the special districts in the county. Housing

The projected demand for new housing in Mesa County as a result of population growth attributed to the Sheridan operation is summarized in table S3-5. The same assumptions regarding household mix and family size that were used in the regional volume were used in these calculations.

Figure S3-1. Greater population pressures would affect the Fruita area.

TABLE S3-3

SHERIDAN: ADDITIONAL REQUIREMENTS FOR COMMUNITY FACILITIES IN MESA COUNTY

Facility	Physical Plant Requirements	Capital Costs - 1990	Operating Costs/Year 1980	Operating Costs/Year 1985	Operating Costs/Year 1990
Water treatment	1.30 mgd	$1,145,000	$19,000	$ 51,400	$ 82,130
Sewage treatment	.37 mgd	1,234,000	13,900	37,700	60,200
Police protection	2 vehicles 1,500 sq. ft.	116,500	20,000	100,000	150,000
Fire protection	1 vehicle 3,740 sq. ft.	224,600	18,000	36,000	72,000
Streets and roads	134.4 acres	4,315,000	30,100	81,200	130,200
General Government	940 sq. ft.	60,500	36,000	72,000	117,000
Libraries	11,200 books 2,050 sq. ft.	151,500	7,200	19,400	31,000
Total	-	$7,247,000	$144,100	$332,900	$642,530

Note: mgd = million gallons per day; sq. ft. = square feet of space.

a/ If amortized at 6 percent over twenty years, the yearly cost would be $631,850.

TABLE S3-4

PROJECTED INCREASES IN REVENUE TO MESA AND GARFIELD COUNTIES FROM SHERIDAN

	1980	1985	1990
Mesa County:			
Property Tax			
Homes	$241,860	$ 609,530	$ 965,120
Businesses	35,740	109,980	148,470
Sales Tax	107,780	291,690	462,270
Service Fees	24,500	55,290	87,580
Total	$409,880	$ 804,490	$1,663,440
Garfield County:			
Property Tax			
Mine	0	$4,085,100	$4,085,100
Coal Mined	$138,550	666,190	948,990
Total	$138,550	$4,751,290	$5,034,090

These housing requirements associated with Sheridan represent about 7 percent of the total projected new housing requirements in Mesa County by 1990. This housing and its related roadway requirements would use approximately 74 acres in 1980; 199 acres in 1985; and 316 acres in 1990.

Education

The expected increase in school-aged population due to the development of the Sheridan mine is shown in table S3-6, along with the increase in school district capital requirements and operating costs anticipated from that population increase.

Almost all of the increase in school-aged population is expected to occur in School District 51 in Mesa County, which includes Fruita and the entire Grand Junction area. District 51 would receive an increase in its assessed valuation of approximately $14.3 million related to population growth from the Sheridan development. The district, however, would not benefit from the valuation of the Sheridan mine installation itself. An increased assessed valuation of $14.3 million would allow District 51 to bond itself for an additional $2.9 million, which would be much less than the projected need for additional capital facilities.

The Sheridan mine is located in School District 49(JT), which has its only facilities in DeBeque. The addition of the Sheridan mine to the DeBeque district should boost its present assessed valuation of $1.3 million by $66.5 million.

Health Care

Population growth associated with the Sheridan mine is expected to increase the demand for health care services in the Grand Junction area. Table S3-7 is an estimate of the capital facilities needed to meet this increased demand for health care services.

Most of the existing health care facilities in the area are supported by fees collected for services performed instead of through local tax revenues.

Employment

Although the Sheridan mine is located in Garfield County, impacts are expected to occur in Mesa County. In 1980, Sheridan expects to employ 173 people, which would increase total employment in Mesa County by 428. In 1985, employment at the mine is expected to reach 470, increasing total employment by 1,162. By 1990, 900 persons would be employed at the mine and total employment would increase by 2,018 which would be a 7.0 percent increase over 1976 total employment of 28,662.

Income

Because the proposed Sheridan operation is so large, it would have a major impact on income in the region. Sheridan did not estimate a potential payroll, but information from other companies indicates that an average income for mine personnel of $16,600 per year could be expected. In 1975 median family income in Mesa County was $11,130, and in Garfield County it was $11,565; both are considerably lower than the projected income for miners.

Using the above rate, total payroll for the Sheridan operation would be $14,940.000 in 1990. The multiplier effect (explained in the regional volume) would add an additional $7,768,000 to the regional income. Total direct, indirect, and induced income from this project would be $22,708,800. Table S3-8 shows projected employment, payroll, and total regional income that would be generated annually for 1980, 1985, and 1990.

TABLE S3-5

SHERIDAN: NEW HOUSING REQUIREMENTS IN MESA COUNTY

Housing Units	1980	1985	1990
Single-family units	187	507	810
Mobile homes	72	195	312
Multi-family units	29	78	125
Total	288	780	1,247

TABLE S3-6

SHERIDAN: MESA COUNTY SCHOOL DISTRICT 51 FACILITY REQUIREMENTS

Year	Increase in School-Aged Population	Facility Requirements (square feet)	Facility Costs (dollars)	Operating and Maintenance Costs (dollars/year)
1980	231	32,300	1,453,000	284,100
1985	537	75,200	3,384,000	660,500
1990	714	100,000	4,500,000	878,220

TABLE S3-7

SHERIDAN: PROJECTED HEALTH CARE FACILITY REQUIREMENTS IN MESA COUNTY

Year	Facility Requirements	Facility Costs (dollars)
1980	3 hospital beds	165,000
1985	11 hospital beds	605,000
1990	15 hospital beds 1 emergency vehicle	840,000

TABLE S3-8

SHERIDAN INCOME

Year	Employees	Payroll	Total Regional Income
1990	173	$ 2,871,800	$ 4,365,140
1985	470	7,802,000	11,859,040
1990	900	14,940,000	22,708,800

CHAPTER 4

MITIGATING MEASURES NOT INCLUDED IN THE PROPOSED ACTION

The mitigating measures proposed in this chapter would reduce, or eliminate specific adverse impacts of Sheridan Enterprises proposed action identified in chapter 3. All measures are considered feasible under existing technology, and if the mining and reclamation plan is approved, they will be required in addition to the federal, state, and county requirements discussed in chapter 1. The first section of this chapter lists the measures, and the second section analyzes their probable effectiveness in mitigating the appropriate impact.

Mitigating Measures

Sheridan Mitigating Measure 1

Roads in the lease area will be for authorized personnel only, in order to reduce the possibility of illegal hunting.

Sheridan Mitigating Measure 2

Power poles will raptor-proofed in accordance with BLM standards as outlined in BLM Manual 2850 and Instruction Memorandum No. C078-30.

Sheridan Mitigating Measure 3

Coal hauling will take place only during daylight hours to reduce the possibility of vehicle-animal collisions on the roads between the mine portals and the loading and washing facilities.

Sheridan Mitigating Measure 4

All fencing along rights-of-way will comply with BLM fencing standards for antelope fence.

Sheridan Mitigating Measure 5

Before developing any surface facilities Sheridan will be required to conduct a Class III Survey on these areas that would be affected by construction activities, as supported in 1971 Presidential Executive Order 11593 and 36(CFR): 800.4a. Any archeological or historic values which are located and evaluated through this survey will be preserved through one or more of the following mitigating measures, depending upon the significance of a site: (1) avoidance of the site through redesign of the project; (2) descriptive and photographic records, or surface collecting; or (3) excavation according to a specific research design or as a salvage effort. Should archeological sites be identified during the survey efforts and placed on the National Register, compliance procedures required by Section 106 of the 1966 National Historic Preservation Act, amended 1976, and outlined in 36(CFR): 800.4-9, will be met.

Compliance procedures as stated above will be met concerning site AR-05-07-382, in consultation with the State Historic Preservation Officer and requiring the approval of the Advisory Council on Historic Preservation.

Sheridan Mitigating Measure 6

A surfactant will be added to the water spray on the conveyors and transfer points. This mitigating measure will be required by the Colorado Air Pollution Control Division as a condition of the mine's operating permit.

Sheridan Mitigating Measure 7

A chemical stabilization of the completed railroad bed will be required as a condition of approval of the right-of-way for the utility corridor.

Analysis of Effectiveness

Sheridan Mitigating Measure 1

Restricting use of access roads to authorized personnel would decrease the killing of animals by an unquantifiable amount.

Sheridan Mitigating Measure 2

Raptor-proofing power poles will prevent electrocution of eagles or other large birds.

Sheridan Mitigating Measure 3

Reducing the number of vehicles on the road during the dusk to dawn hours would reduce the road kills by an unquantifiable amount.

Sheridan Mitigating Measure 4

Antelope fencing along the rights-of-way would allow the antelope to freely move across the rights-of-way and eliminate any possibility of the antelope getting caught in the fence.

Sheridan Mitigating Measure 5

Identification, evaluation, and preservation of data from archeological sites prior to potentially damaging actions would mitigate the loss of archeological resources. The results of the Class III survey, as a 100 percent surface inventory of the impact areas, are considered to be representative of the archeological values in that area. The efficiency of the Class III survey as an identification process would depend on topography, vegetation, and past land use on each site. These factors would account for the possibility that hidden and subsurface sites would remain undetected and unaccounted for in developing any further necessary mitigating actions.

Collection and excavation are only partial mitigations. While they preserve artifacts which might otherwise be destroyed, the inplace value of those artifacts is lost. Destruction of the site would mean the loss of information which might otherwise be gained by future techniques and interpretive methods.

Sheridan Mitigating Measure 6

In the mining plan, Sheridan proposes that the conveyors and transfer points be controlled by water spray, with an estimated 50 percent control efficiency. By adding a surfactant to the spray system for longer-duration dust suppression, an estimated 85 percent reduction can be achieved. The use of a surfactant would reduce projected 1980 emissions from these two sources by 40 tons per year, 1985 emissions by 191 tons per year, and 1990 emissions by 273 tons per year.

Sheridan Mitigating Measure 7

Although no application for the right-of-way has been received yet and additional environmental assessment will be required for the utility corridor route, analysis in this ES identified a definite need for dust control of the railbed. No dust controls are indicated for the 222 acres of exposed area along this 19 mile right-of-way. Chemical stabilization of the completed roadbed would reduce wind erosion emissions by at least 80 percent (EPA 1977), or 54 tons per year.

CHAPTER 5

ADVERSE IMPACTS WHICH CANNOT BE AVOIDED

Chapter 5 discusses unavoidable adverse impacts which would be caused by the construction and operation of Sheridan Enterprises' proposed action. These impacts include the residual impacts after application of the mitigating measures discussed in chapter 4.

Air Quality

Annual average concentrations for the study area were predicted with the model discussed in chapter 3, substituting the reduced emissions obtained with the mitigating measures. Table S5-A presents the total annual expected emissions for each study year that would result from the mitigating measures. This reduction in emissions would result in a lessening of air quality impact. Because of the modeling procedure used, short-term maximum concentrations should decrease in direct proportion to emission reductions.

The Loma project would increase annual average particulate concentrations by 20 micrograms per cubic meter ($\mu g/m^3$) in a small area on the mine site near that section of the haul road used for both raw and clean coal transport. Concentrations are predicted to increase by 5 $\mu g/m^3$ within 0.5 mile of either side of the section of haul road used to haul clean coal to the loading facility. Maximum 24-hour concentrations from the mine directly south of the facilities would be 66 $\mu g/m^3$ in 1980, 78 $\mu g/m^3$ in 1985, and from 65 $\mu g/m^3$ (winds from the south) to 90 $\mu g/m^3$ (winds from the north) in 1990. Visibility in the canyon would be reduced by about 6 miles in 1980; the reduction in visibility would be less in 1985 and 1990.

TABLE S5-A

TOTAL ANNUAL PARTICULATE EMISSIONS

(ton/yr)

Study year	Without mitigating measures	With mitigating measures	Percent reduction
1980	1389	1349	3
1985	921	676	27
1990	1161	834	28

Geologic and Geographic Setting

Topography

The proposed mining operation would result in minor alteration of the surface from installation, use, and removal of surface facilities and subsequent reclamation of the area. Subsidence of a maximum of 8 feet would occur as the result of mining. Due to the speed and method of mining, surface slumping and fracturing would be minimized. However, some hazard and erosion potential would exist.

Paleontology

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The significance of this impact cannot presently be assessed because of the lack of data and evaluatory criteria.

Mineral Resources

Mining the coal under the proposed Loma project would have an unavoidable effect on the coal beds and coal reserves by depletion of a nonrenewable energy source. Based on company plans, the estimated 100 million tons of recoverable coal reserves would be mined by 2000. The estimated recoverable coal reserves under the Loma project constitutes approximately 12 percent of the total coal reserves over 42 inches in the Garfield County portion of the Colorado section of the Little Bookcliffs coal field. Because of the nature of underground caving and resultant high contamination, future recovery of the abandoned 50 to 60 percent of the coal reserves is not considered feasible under present technology, and therefore those reserves must be considered as lost.

Water Resources

There would be an increased consumption of municipal water of 339 acre-feet per year in 1980, 919 acre-feet per year in 1985, and 1,175 acre-feet per year in 1990.

All facilities and portal areas at the Loma project, except portal areas No. 3 and No. 4, are liable to inundation by flash flood waters. Flash flooding through the refuse disposal area could cause high erosion and downstream sedimentation which could further degrade the quality of water in the Colorado River.

Soils

Existing and proposed surface disturbance on approximately 39 acres in 1980, 649 acres in 1985, and 676 acres in 1990 at the mine site and within the utility corridor would cause an increase in erosion and a deterioration of soil structures and biological activity, leading to a temporary reduction in soil productivity. Any such reduction would pro long the efforts necessary to achieve successful reclamation.

Erosion would be largely contained on-site where runoff did not exceed that of the 10-year/24-hour precipitation event. For storms above this level, soil would be permanently lost from the site.

Urban area expansion would permanently remove 74 acres from a production function by 1980, 199 acres by 1985, and 316 acres by 1990. Although exact locations are not known, some of this acreage would likely come from lands either now classified or eligible for classification as prime or unique farmland.

Vegetation

Vegetation would be lost at the mine site on 39 acres in 1980, 649 acres in 1985, and 676 acres in 1990. If parts of the disturbed areas are revegetated before abandonment of the mine (on refuse piles, road cutbanks, etc.), the actual acreage lost would be slightly less than those figures. An unquantifiable amount of vegetation would be disturbed by increased off-road vehicle use resulting from population expansion associated with the proposed action.

Wildlife

Surface facilities covering 39 acres in 1980, 649 acres in 1985, and 676 acres in 1990 would completely destroy wildlife habitat for the life of the project. These acres would have supported 11 deer in 1980, 171 deer in 1985, and 178 deer in 1990. Reduced wildlife use would occur on an additional 4,000 acres through 1990.

Cultural Resources

Archeological Resources

Undiscovered sites could be damaged during surface disturbing activities. Information could be lost as a result of illegal collecting and vandalism and through incomplete excavation procedures where information not recorded would be permanently lost.

The integrity of petroglyph AR-05-07-382 would be destroyed by the alteration of its physical setting by mine activities and by possible damage from vandalism.

Transportation

Increased traffic from coal haulage and from employees would cause an increase in the number of accidents. Maintenance on the roads would be much greater. Six unit trains per week would in-

CHAPTER 8

ALTERNATIVES TO THE PROPOSED ACTION

No Action Alternative

The no action alternative includes analysis of impacts that would occur if the mining and reclamation (M&R) plan and the associated railroad right-of-way are not approved. Rejection of Sheridan Enterprises' proposed M&R plan would result in no additional environmental impact from coal mining on the federal leased lands. Since these lands are public lands surface use would be governed by Bureau of Land Management (BLM) policy and management guidelines and decisions. Sheridan Enterprises could submit a new M&R plan, challenge the rejection, or abandon development of the lease.

Coal from the proposed Loma project is intended to supply 100 million tons of coal to utility plants in the midwest and southwest for use in the production of electrical energy. Without the Loma mine, other coal would have to be acquired to supply these markets. Such a substitution could create a shortage for other coal markets.

Under the no action alternative, future air quality at the Loma mine site is expected to be nearly the same as existing air quality, about 40 micrograms per cubic meter.

The primary use of the vegetation would be livestock and wildlife forage. Two stock reservoirs, three cattleguards, and approximately 0.5 mile of fence are proposed to be constructed on the area. If an allotment management plan (AMP) is implemented on the Garr Mesa Allotment, the part of the allotment within the lease areas would be placed in a two-pasture cycle of spring and fall use one year and fall use the next year. If the AMP is implemented, vegetative condition may improve due to an increase in density of the key species (galleta grass, Indian ricegrass, Colorado wildrye, and western wheatgrass). A decrease in the hedging of serviceberry would also be expected.

Wildlife habitat conditions should improve if the Garr Mesa AMP is implemented. However continuing human population growth in Mesa County would still cause impacts to wildlife: expansion of urban areas onto agricultural lands and some winter range; increased recreational use of wildlife species, primarily hunting; and increased poaching of big game species.

The rejection of the M&R plan would lessen the projected use of existing recreational facilities in the area, and there would not be a need for an additional 8.9 acres of active/improved park land. There would be fewer hazards to recreational drivers on State Highway 139.

Without the proposed facilities, East Salt Creek and adjoining canyons would be improved visually. Rehabilitation of the disturbance around the exploratory sites and the access roads would bring the affected landscapes back to a scenic quality Class B.

Natural weathering and vandalism would continue to be the major causes of loss of archeological and historical values, but there should be no additional contributing factors to such loss at the site if the M&R plan is rejected. Paleontological resources would be impacted both adversely and beneficially in approximate proportion to the level of regional development and the area disturbed.

The population of Mesa County would still increase at a rapid rate to 87,385 people in 1980, 106,860 people in 1985, and 106,990 people in 1990. Development of oil shale and uranium and the area's role as a regional center account for the growth. Garfield County is also projected to grow at a rapid rate to 34,100 people in 1980, 42,900 people in 1985, and 46,600 people in 1990, also primarily as a result of oil shale development.

Operational Alternatives

Alternative sites for surface facilities, mining techniques, methods of coal transports, and rates of production have been considered but no such modifications have been proposed or identified in this case which would significantly reduce the adverse impacts of coal production. Surface mining is not feasible due to the geology and geographic characteristics of the area. Any new alternatives presented by the review process will be carefully considered.

☆ U.S. Government Printing Office: 1978-778-577/Region 8

NOTICE

Enclosed for your review and comment is the Draft West Central Colorado Coal Environmental Statement.

We would appreciate receiving your comments on the adequacy of this environmental statement. The comment period will run for 45 days after the draft is filed with the Environmental Protection Agency and the notice of availability is published in the Federal Register. The statement is anticipated to be filed with EPA on July 28, 1978. Public hearings will be held in Delta, Grand Junction, and Denver, Colorado, on September 13, 14 and 15, respectively. Details of the hearings will be advertised at a later date.

Your comments should be sent to:

Montrose District Manager
Bureau of Land Management
Highway 550 South
P. O. Box 1269
Montrose, Colorado 81401

ERRATA

1. Visual Resources was inadvertently left out of Mid-Continent: Coal Canyon, Chapter 3, page 577. It is included with this errata sheet.

2. In all Air Quality, Water Resources, and Aquatic Biology sections (both regional and site-specific), the superior and inferior numbers for scientific notations appear as regular numbers, as follows:

$\mu g/m^3$ = μg/m 3
NO_x = NO x
SO_x = SO x
NO_2 = NO 2
SO_2 = SO 2
NH_4 = NH 4
FeS_2 = FeS 2
B_1 = B 1
B_2 = B 2

crease congestion on area rail facilities. Passenger traffic at Walker Field would also increase.

Livestock

The following livestock forage would be lost: 3 animal unit months (AUMs) per year due to disturbance of 39 acres in 1980; 41 AUMs on 49 acres in 1985; 48 AUMs on 676 acres in 1990. Increased off-road vehicle use would decrease productivity of natural vegetation by an unquantifiable amount. Agricultural lands disturbed by urban expansion would result in the loss of an unquantifiable amount of livestock forage and livestock wintering areas.

Recreation

If the community recreation facilities needed to prevent deterioration of existing facilities are not provided, this deterioration would be an unmitigated impact.

The hazards to recreational users of State Highway 139 from coal trucks would be an unmitigated impact until 1982 when train haulage of the coal would reduce this impact.

Visual Resources

During the mining period, there would be a definite alteration of the natural landscape character since visually incongruous elements of the proposed action cannot be mitigated. Plant and refuse areas would remain apparent in the landscape for the life of the mine. Once all structures have been removed and the disturbed landforms have been regraded and revegetated, visual impacts would be minimal.

Socioeconomic Conditions

Population influx resulting from the Sheridan mine development would have its greatest effect on the community of Fruita. Fruita has been growing at a rapid rate over the past few years, undergoing a change from an agricultural community to a diversified community whose economic base is the entire Grand Junction area. A rapid increase in population growth, however, is likely to detract from the rural, small town character which still exists in Fruita. It is not expected that population growth from the Sheridan mine would have a similar pronounced effect upon Grand Junction, because the new population would be more easily absorbed by that community.

Most of the income that local governments would receive from the Sheridan development would go to Garfield County. This could be as much as $5,034,090 a year when full production is reached. Mesa County could receive $1,663,400 in revenues and some monies from the local government severance tax fund and the local government impact fund but the amounts would be small.

Public school expenditures required to support the increased school-aged population generated by the Sheridan mine would also exceed the local school district's ability to pay. An estimated additional $1.6 million would be needed to compensate for the difference between increased school capital requirements associated with Sheridan and the increases expected in district bonding capacities.

The conversion of vacant land for urban purposes would preempt the future use of that land for any other purposes. About 74 acres of land by 1980, 199 acres by 1985, and 316 acres by 1990 would be converted to residential use in Mesa County to accommodate the population influx from Sheridan.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The mining of 100 million tons of coal would result in short-term and long-term alteration of natural resources and the human environment.

There would be the following alterations in the short term, a period beginning with on-site construction and ending with end of mine life (about 2000) and post-mining reclamation:

1. An estimated 100 million tons of coal would be exported to utility plants in the midwest and southwest for use in the production of electrical energy.

2. Annual average particulate concentrations would increase by 20 micrograms per cubic meter ($\mu g/m^3$) near the mine site and by 5 $\mu g/^3$ within 0.5 mile of either side of State Highway 139 into Loma through 1990. Maximum 24-hour concentrations directly south of the mine would be 65 to 90 $\mu g/m^3$

3. Throughout the life of the mine, water quality changes would be minimized by the site drainage system. Nevertheless, this system is only designed for the 10-year/24-hour event. Runoff amounts exceeding the design value are not covered by existing effluent standards. In such cases, sediment and other debris from the mine site would then cause at least short duration impairment of stream quality with resultant negative impacts on aquatic biology.

4. There would be loss of soil productivity on 676 acres through 2000 due to increased erosion, deterioration of soil structure, and reduced biological activity, and there would be loss of vegetation on these 676 acres through 2000 due to loss of soil productivity.

5. Wildlife habitat on 676 acres, which could have supported 178 deer annually would be completely lost through 2000.

6. Increased traffic from coal haulage and from employees would increase the number of road accidents.

7. Six unit trains per week would increase congestion on area rail facilities.

8. Approximately 48 animal unit months (AUMs) of livestock forage would be lost annually through 2000.

9. The scenic quality of this section of East Salt Creek would be reduced by the dominance of the surface facilities through 2000.

10. Population influx from the development of the Sheridan site would cause some growth related problems in the western portion of Mesa County over the short-term. The revenue generated by local property and sales taxes in Mesa County from Sheridan would lag behind the increased expenditure needed for community facilities until after 1985, forcing either an increase in local tax rates or a foregoing of adequate service levels. An estimated additional \$1.9 million would be needed to compensate for the difference between increased school capital requirements associated with Sheridan and the increases expected in district bonding capacities. Whether this situation persists beyond the short-term would be determined by the rate at which other energy resources, particularly oil shale, in the area are subsequently developed.

11. Total direct, indirect, and induced income generated by this project would be \$22,708,800 by 1990.

Residual effects of mining (after post-mining reclamation) on long- term productivity would be as follows:

1. An undetermined number of uninventoried exposed and unexposed fossil resources would be impaired or destroyed.

2. An unquantifiable gain in knowledge would result from surveys and exposure of fossil resources which might never have been found without development.

3. An estimated 100 million tons of coal, a nonrenewable energy resource, would be depleted after 2000.

4. There would be an increased consumption of at least 1,175 acre- feet of municipal water per year through 2000 and beyond.

5. Soil and natural vegetative productivity would be permanently lost on 316 acres due to urban expansion.

6. Surface construction, subsidence, and vandalism would disturb or destroy an unquantifiable number of nonrenewable cultural resources.

7. Archeological survey and excavation could provide gains in understanding of prehistoric use in the area.

8. Approximately 88 AUMs of livestock forage per year would be restored on the lease area upon revegetation after the mine is abondoned.

9. If additional recreational facilities are provided to meet the increased demand, they would remain for long-term use; conversely, if additional facilities are not provided, the deterioration of present facilities would be a long-term adverse impact.

10. Following abondonment and reclamation, areas of altered topography, such as the terraced refuse pile and road cuts, would remain visible even after vegetation.

11. Rapid population growth in Fruita is likely to detract from its rural, small town character.

12. At least 316 acres would be committed for urban expansion.

VISUAL RESOURCES

The most significant visual changes caused by the construction of the mining complex would result from the leveling and grading for surface facilities, portals, evaporation ponds, and refuse sites. Landfill to provide a base for mine portal roads would establish a unique landform and linear component on the landscape. The existing canyon access road follows the bottom of the canyon with minimal disruption. Widening this road or constructing a new road would involve cut-and-fill alterations that would significantly contrast with the present landform. All of these modifications would interrupt the sparse vegetative cover, altering that surface texture and inhibiting the visual integration of the proposed facilities into the landscape. In addition, the dark-colored coal refuse would at first be defined noticeably against the light-colored rocks and soils and would, therefore, disrupt the natural landscape.

The combined form, line, and texture changes would be readily visible on the steep side slopes because of the lack of terrain or vegetative masking in the canyon. The recreation potential of the Little Bookcliffs Wild Horse Area, in which Coal Canyon is included, requires the preservation of its present scenic quality (Class "B" and VRM Class II). The proposed project would generate landscape changes that would lower the canyon's aesthetic quality and degrade its recreation potential for the growing Mesa County population (1975 - 62,822, 1990 - 116,134). Since Coal Canyon is in the Little Bookcliffs Wildland Study Area, the modification of its scenic values could decrease its suitability for designation as wilderness.

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 100 million tons of coal would be recovered from the Loma project mine. About 150 million tons would be lost due to current mining methods.

Energy, in the forms of petroleum products and electricity, would be expended to obtain the coal. Some materials used in manufacturing machinery and buildings would not be recycled and thus would be lost.

An undetermined number of uninventoried fossils would be lost or disturbed.

Soil and vegetative production would be irretrievably lost on 676 acres for the life of the mine, and irreversiblly lost on an unquantifiable number of acres due to off-road vehicle use.

Wildlife habitat on 676 acres, which could have supported 178 deer per year would be irretrievably lost for the life of the mine.

Approximately 48 animal unit months of livestock forage would be irretrievably lost for the life of the mine. An unquantifiable amount of livestock forage and livestock wintering areas would be irreversibly lost due to disturbance of agricultural lands by urban expansion.

Anything other than in-place preservation of archeological artifacts involves an irreversible, irretrievable commitment of the resource. Damage from surface disturbance or vandalism would result in a permanent loss of information and would remove archeological values from future research considerations.

The development of a mining complex in and around East Salt Creek would establish an industrial landscape area in a relatively undisturbed portion of the Roan Plateau. The operation of the mines for over 25 years and the growth generated by a projected 900 employees would initiate a series of irreversible visual changes, and future generations would be committed to more developed landscapes.

Some changes are expected to take place in the rural community environment which now dominates western Mesa County. An irretrievable commitment of capital and lands (at least 316 acres) would be required to support population growth.